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Handsomely bound volumes of THE ELECTRICAL WORLD *for* 1884 *are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

AN interesting fact is brought out by the statistics of telephones in Europe, which we give on another page. It is that the increase in the number of subscribers in the more sparsely settled countries is far beyond that at the great centres of commercial activity. It would be interesting to trace the reason for this, which might possibly be found in the restrictions put upon the development of electrical inventions by some of the great powers. The figures seem to us open to question.

A CORRESPONDENT at Fort Madison, Iowa, writes us as follows: "Some time since we saw, and think in your paper, notice of a little electric instrument to put in vest pocket, and going in the rain you would be kept dry. Are we correct? If so, please tell us where to find it." We believe our correspondent refers to our excellent contemporary, *The Arabian Nights' Entertainments*, in which several useful inventions of this nature are described. The *Patent Office Gazette* often gives particulars with respect to latest novelties of the same kind, but has not yet made any reference to the vest-pocket umbrella.

RECEIPTS of the English postal telegraphs, from the time when private control ceased down to the end of March, 1884, amounted to ninety million dollars and the working expenses to eighty millions. This does not leave much toward the extinction of the debt incurred by the government fifteen years ago, or even the payment of interest thereon; and it remains to be seen whether the sixpenny (12-cent) rate will assist in lessening the indebtedness or will add to the burden of yearly expenditure.

WE are glad to learn from our foreign contemporaries that the electrical exhibition now being held at the Paris Observatory, under the auspices of the International Society of Electricians, is a success. It does not appear, however, that any of the exhibits are novelties. About 200 horse-power is supplied for lighting purposes. Several interesting papers are promised by leading French electricians, to be read at the conference that supplements the exhibition, after the manner of the proceedings at Philadelphia last year.

THOSE of our readers who are interested in the New Orleans Exposition will find in the last two numbers of *Industrial America*, published from this office, a record of that great Exhibition which is worth preserving. Nor is this all the attention that the Exposition will receive in that journal; but several succeeding numbers will contain handsome illustrations of the fine exhibits of American industry shown there. In addition, there will be several series of special illustrated articles, contributed by well-known experts. We believe that any one interested in the industrial arts will find the paper both useful and entertaining.

OUR French friends are now so fully appreciative of the telephone that they have determined to make the most of it. Tickets have been issued in Paris at 50 centimes, or 10 cents, each, and any one with a ticket can go into a post-office there and hold five minutes' conversation with persons in any other post-office, or at any of the telephone stations. The telephone company also offer, at the same rate, the use of any of their eleven stations for conversation with persons at any other station or with any of their subscribers. It has further been decided by the Society of Ambulances to establish telephonic communication between the drug stores and the hospitals in the different districts of Paris, so that in case of accident, relief or removal to the hospital may be immediate.

REPORTS of a contradictory nature continue to circulate regarding the offer of the Western Union Company to sell out its telephone rights to the American Bell Company. The old adage says that there is no smoke without fire. The inducement or necessity that will lead the Western Union Company to give up its 20 per cent. of rentals paid to the Bell Company—not 20 per cent. of earnings, as some of the daily papers put it—must, however, be a very urgent and pressing one. The statement that the Western Union Company is willing to take $1,000,000 cash down seems preposterous, in view of the fact that its 20 per cent. is worth about $400,000 per annum. Whatever the new "deal" may be, the authorities at 195 Broadway will be shown by it to be able to drive a good bargain for themselves.

BY many people treated as a mere pretext of evasion, the argument that to turn up the streets of New York this year, in order to put the wires under ground, would invite pestilence, is now echoed and put forward as reasonable by the leading phyicians of the city and the Health Commissioners. Apprehending a visitation of cholera, they all say that the exposure of the subsoil, saturated as it is with coal gas and other noxious gases, would be highly dangerous to the public health. This argument is a new and strong plea in favor of the electric light. Excavations of all kinds along the city thoroughfares are to be stopped—and wisely—because the escape of coal gas from the mains has poisoned the soil everywhere; and, for the same reason, breaking up the streets at any time is unhealthy. The use of electric light wires involves no objections of this nature.

ALL exhibitions nowadays are lighted by electricity, and while the electric light has entered fairly upon its commercial development, in cities, houses, factories and steamships, it is increasingly resorted to as a means of obtaining scenic effects at all the great shows. Gas may still hold its own in domestic lighting, but for large buildings and crowds of people it is entirely out of favor. The electric light has been one of the most attractive features at all the recent exhibitions in this country, notably that at New Orleans, and it has also been largely patronized as an element of the picturesque, and because of its vastly superior powers of illumination by the exhibition managers in England. At the Fisheries Exhibition in London in 1883, and again at the "Healtheries" in 1884, it was one of the most popular attractions, and now it is to be used at the Inventions Exhibition on a still more extensive scale. When the installations are complete about 500 arc lamps and 10,000 incandescent will brighten the lofty aisles and green lawns of the exhibition at South Kensington. The total illumination indoors is estimated at 533,000 candles, and it is pleasant to think that thousands of sightseers will enjoy the exhibition nightly by means of electric lights that neither heat the air nor vitiate it.

A GENTLEMAN of fine ear, who uses the telephone frequently, suggests to us that it would be a good thing to give the exchange operators a few lessons in elocution, so that they might reply to calls with less nasality, shrillness and snappiness of utterance. We submit the proposition to telephone managers for what it is worth. It is to be feared that the rapidity of work in American exchanges will hardly allow the operators to acquire that musical suavity of response for which their less worried Mexican sisters have already become noted. Was it not the poet Coleridge, who, on asking a Hebrew dealer in shed garments why he clipped the English language so outrageously, was answered sharply and conclusively that he, too, would say "Ole clo'," if he had to utter the cry as often? A telephone operator responding to a call every minute, falls naturally into a set tone and form of speech, and it is not likely that lessons in elocution would improve her peculiar style of enunciation. Still, the experiment might be tried in New York by sending some of the young ladies to Mr. Steele Mackaye's school, or if Mr. W. H. Eckert would himself conduct an elocution class in the evening, he might experience very little difficulty in enticing the operators away from that special detestation of his, the attractive skating rink.

WARS and rumors of war always act as great stimulants to invention, and it would not be surprising if the present state of things at home and abroad led to some new and ingenious applications of electricity to naval and military purposes. Last year Col. John Hamilton, in his report on artillery practice at the Narrows, New York Harbor, enlarged with much force on the superiority of electricity over steam or compressed air for working guns. He pointed out how easily the current might be conveyed from a distance to motors at the guns by means of a cable that could, in the improbable event of breakage, be repaired promptly, and he suggested that a handy reserve of power might be stored up in secondary batteries, so as to provide for damage to the primary apparatus. "In all cases," he said, "the machinery should be of such character as to enable the person sighting to make the requisite movement rapidly by a touch of the finger." Here is one opportunity of application, and we note that in England some recent developments made with the Maxim electrical training gear for heavy ordnance promise to be of the greatest service. The year is so contrived that by moving a handle the breech of the gun can be moved to the right or left, and the muzzle raised or depressed. A small switch controls the speed of two motors, which may be run together or independently in either direction. The movement of the handle makes the necessary connection with the motors and cuts out resistance as it is pushed in the direction it is intended the gun should take. With this gear one man can train with accuracy and quickness the big 38-ton guns mounted in the English seaside forts.

AFTER a very careful consideration of the case, the Electric Lighting Act Committee, that was formed lately in England and comprises all the most influential and distinguished men connected with electric lighting there, has come to the conclusion that it will be best for everybody—companies and consumers alike—to repeal the clause that gives communities the right to purchase plants after they have been in operation a certain time, whether the owners wish to sell or not. Experience has clearly shown that persons with capital will not go into a new experimental business with the great chance of being bought out after they have incurred all the losses of the preliminary stages and are about to reap the profits that should reward their sacrifice, enterprise and foresight. The committee suggest that the same rule should apply to electric lighting as to gas companies, namely, that a certain maximum price should be fixed for supply, and that a maximum rate of dividend, not to exceed 10 per cent., should be allowed so long as the charge was not departed from. If a reduction of price be made, a sliding scale should then come into operation, the dividend increasing as the price went down. Various other recommendations are made. The committee point, though not with pride, to the development of electric lighting in America, and say: "Having regard to the keenness of competition which has now overtaken the long disputed lead of this country in industrial progress—having regard to the circumstance that England is already distanced by America in the industry of electric lighting—that this may be a step toward leaving to America a permanent lead in the new applications of science, * * * we think the Board of Trade will attach due weight to the importance of giving at this critical stage a fair field to the development of electric lighting enterprises." The committee promise that if electric light undertakings are put on the same footing as gas, the experiment of central station lighting will be tried in England on a scale that will mean serious and sustained competition with all the older methods of illumination. We hope that the firm, temperate and logical report of the committee will have the desired effect.

The Bell vs. Baxter Case.

We give below the full text of the oral opinion of Judge Wallace in favor of the American Bell Company against the Baxter Overland Telephone and Telegraph Company of Central New York *et al.*, delivered in the United States Circuit Court of the Northern District of New York:

This is a case in which an injunction must issue, beyond any sort of doubt. The questions upon the merits, for the purposes of a preliminary injunction, have been already disposed of in the Pennsylvania and New Jersey cases. The only question is whether there are any particular equities on the part of this defendant which should exempt it from the stringency of preliminary injunction. There might be some foundation for that if the only complainant here was the original Bell Telephone Company; but there is this subordinate company, whose whole life and value, or whose entire business is being destroyed by the action of the defendant. The Central New York Telephone and Telegraph Company was organized before this defendant was. It was entitled to this territory, and the defendant, while the motion for injunction was pending in Pennsylvania, goes on and organizes and takes possession of this territory, defies the parent company and defies the local company which was organized under the parent company, and falls back upon its parent company, the Baxter concern, which has been defeated in every case in which the question of its right to go on has been considered. There are no equities in this case, that I can see, in favor of the defendant as against the subordinate company, the Bell Company here. If this case were in the position of the Philadelphia case, so that it might be heard in a month or two on the merits, there would be a good deal of reason for saying the motion for injunction should be suspended until the hearing. We cannot tell when this case can be heard. In the meantime, the Central New York Telephone Company may be ruined by the competition of the defendant. An injunction is granted.

The Right of Telephonic Communication.

We stated briefly last week that the United States Court at St. Louis, Mo., had decided in favor of the application of the Baltimore & Ohio Telegraph Company to the local telephone exchange for a connection for the collection and delivery of telegrams, on the same terms as the Western Union Company. The circuit judge, Brewer, gave the favorable decision, which is binding until overruled by the Supreme Court of the State, although the district judge dissented. Judge Brewer said:

"Now the question is whether the court can compel this defendant, doing the telephonic business of this city, to establish communication with any other individual, or company, than that permitted by its license from the patentee.

"I believe fully in the sacredness of property, but I think all property stands upon an equal basis, whether that property consists of gold dollars in your pocket, real estate, or the ownership of a patent. There is no particular sanctity hovering over or attaching to the ownership of a patent. It is simply a property right, to be protected as such.

"Starting from that as a basis, while every property owner may determine for himself to what he will devote his property, the moment he puts his property into what I perhaps may, for lack of a better expression, define as the channels of commerce, that moment he subjects that property to the laws which control commercial transactions. Just as in the warehouse cases, Munn against the State of Illinois, decided by the Supreme Court and reported in 94 U. S., 113, in which that court held that when an individual built a warehouse, and put his property into that kind of business, he subjected the property thus placed to the laws which controlled the transactions of commerce, involved in which was the power of the public, through the Legislature, to regulate rates. No man holding property was bound to build a warehouse, or bound to put his property into that particular channel, but the moment he did so he put it where the Legislature would say: 'You may charge so much and no more for the transaction of this business.' He put his property in the channels of commerce, as multitudes are doing in the railroad business, into the express business, and into other channels of commerce. Whenever the property is put into these channels it is put within the power of the public, speaking through its legislature, or the power of the court enunciating general rules operative upon such transactions, to modify leases, modify licenses, control duties. So, notwithstanding this licensor has given to the licensee the right to establish a telephonic system in the city of St. Louis, with telephonic communication with only certain prescribed telegraph systems, the moment it permitted the establishment of a telephonic system here, that moment it put such telephonic system within the control of the State of Missouri and the control of the courts enforcing the obligations of common carriers. A telephonic system is simply a system for the transmission of intelligence and news. It is perhaps in a limited sense, yet in a strict sense, a common carrier. It must be equal in its dealings with all. It may not say to the lawyers of St. Louis, 'My license is to establish a telephonic system open to the doctors and merchants, but shutting out you, gentlemen of the bar.' The moment it establishes a telephonic system here it is bound to deal equally with all citizens in every department of business, and the moment it opened its telephonic system to one telegraph company that moment it put itself in a position where it was bound to open its system to any other telegraph company tendering equal pay for equal service.

"So my conclusion is, that, notwithstanding the terms of the license, which seem to inhibit it from dealing or giving its telephonic privileges to any other telegraph company than the Western Union, the moment it established its telephonic system here, that moment it compelled itself to respond to the demands of any telegraph company or any individual in the city tendering to it equal pay for equal services. The mandamus will be sustained."

The objection of District Judge Treat was that he knew of no power in a court which can modify a contract between the licensor and the licensee, and give him a contract other than what he has made, either by enlargement or diminution.

The Jenney Lighting Interests.

The subjoined important announcement is made by the Indianapolis *Journal* of April 2:

Under an act for the incorporation of manufacturing companies, etc., the Jenney Electric Light Company, of this city, has filed articles of association with the Secretary of State and county auditor.

The incorporators, who constitute the directory and also the sole membership of the company, are Addison H. Nordyke, Daniel W. Marmon, Amos K. Hollowell, Brainard Rorison and Charles D. Jenney. This is an industry of very great importance, and Indianapolis is to be congratulated upon the accession as a citizen of one of the very few electricians of the country, Mr. Charles D. Jenney is barely of age. Before he was seventeen he invented a dynamo-electric machine which was the basis of the organization, in 1881, of the Fort Wayne Jenney Electric Light Company, comprising among its incorporators prominent and well-known business men of Fort Wayne. It has been during the past year probably the most prosperous corporation in Fort Wayne, its plants having been put up in almost every State in the Union. Mr. Jenney, however, chafed under the contract which mortgaged his inventions, past and future, to that company for life, and a few weeks since, on reaching his majority, he rescinded the contract. He brings to the present company, of which he is a member, the exclusive right to all of the inventions used heretofore by the Fort Wayne Company, which have made the name "Jenney" famous for electrical appliances, and which secured for it the first three premiums for the three principal points of merit at the Louisville Exposition. The prospect is favorable for a like award at New Orleans, and a contract was entered into last week for the lighting of a large portion of that city by the Jenney system. The other members of the new company are well known here. The Nordyke & Marmon Company, which includes Mr. Hollowell, is one of the largest milling machinery houses in the country, employing from 400 to 500 men, and sending its products to every civilized country. The interest of such men is of itself almost in the nature of a warrant of success. Brainard Rorison is known to every one through his connection with municipal matters, as president of the Board of Aldermen, and especially through his association with the Connecticut Mutual, whose very large Indiana business he had the control of as its general agent for more than fifteen years. He will resign this position to engage in the active management of the new company, in the interest of which he is now at New Orleans. The necessary accommodations will be given at the works of the Nordyke & Marmon Company for the prosecution of the business until the new buildings and factory of the company can be erected.

The Transmission of Power in New York City.

The Electric Power Company, an organization composed of some of the most prominent business men of New York City, have commenced active work, having purchased the rights of the Daft Electric Light Company for the counties of New York and Westchester, this State. The company take as a nucleus the plant put in by the Daft Company on Spruce street, New York City, in January, 1884. This plant consisted of a six horse-power dynamo located in Buxton, Heims & Co.'s steam power plant, 13 Spruce street. At first wires ran only to Studwell & Sanger's well-known leather house, Nos. 32 and 33 Spruce street. The motor there ran their elevator, its maximum load being 2,000 pounds. In March the plant was increased, another motor similar to the former being put in another leather house, that of Mulford, Cary & Conkling, next door to the above. This motor did similar work and ran in parallel with the first. These motors now show but trifling wear. The same armatures, the same commutators, the same everything, are to-day in use. The commutators of the motors have not yet been turned, the wear after a year's run not yet warranting it, although tons have been hoisted daily. Their run has been extraordinary. They demonstrate beyond all question their eminently practical qualifications for such work.

Two weeks ago the Electric Power Company substituted one of the Daft Company's largest dynamos in place of the smaller one at 13 Spruce street. It is their intention now to add as rapidly as possible to the plant. A large order has been handed the Daft Company for motors, aggregating some 30 horse-power. The business of the new company is in able hands, and we feel sure that a revolution of motive power in New York City has started.

Economy of room, economy of money, are the desiderata. They will be realized. G. W. M.

A Long-Pull Electro-Magnet.

That an electro-magnet is capable of being made to develop enormous power which might be utilized for the purpose of actuating levers, or of doing other equivalent mechanical work, has long been well known. But it is also equally well known that in practice there are several drawbacks to its usefulness in this direction. The longest direct pull that can be obtained with an ordinary electro-magnet is only half an inch, but even with this pull the final shock or impact is so severe as to be injurious to fastenings and connections. Moreover, to obtain a practical pull of even half an inch necessitates the use of a very high electromotive force and a powerful magnet, and this great power is nearly all wasted at the final part of the pull. Hence, ordinary electro-magnets are costly in construction and expensive in their working, so that for all practical purposes where a powerful pull is required the electro-magnet has hitherto been kept out of the field. That this, however, is no longer the case has been amply demonstrated by the successful working of a set of railway signals and points which we recently witnessed at the works of the Gloucester Wagon Company, Gloucester, the signals being actuated directly by a new electro-magnetic arrangement. This consists of a long-pull electro-magnet, the invention of Mr. Stanley Currie, which has been wedded to a system of interlocking railway signals and points. The bobbin of the Currie electro-magnet consists of an annular chamber of soft iron in which the coils are placed, the centre portion of the chamber being hollowed out to receive the stem of the armature for which it acts as a guide during its descent. The armature is composed of a pair of soft iron plates of the same diameter as the bobbin, carried on the stem just referred to, and having a rim of iron on its circumference, the whole forming, as it were, a lid or cover to the bobbin. The inside of this rim is stepped, and the bottom of its outer and thinnest edge is corrugated. The outer portion of the stem of the armature is of iron, and the lower part is of gun metal.

The result of this ingenious arrangement is that instead of the action being practically instantaneous, the impact very violent, and the pull very short, as in the ordinary electro-magnet, the action is very gradual, the impact gentle, and a pull of several inches is obtained, hence its name—the long-pull electro-magnet. The length of the pull, moreover, can be graduated according to requirement, and the principle involved is capable of application whenever a mechanical pull is required. As applied to railway signals, the electro-magnet is carried in a small box attached to the top of each signal post, where it actuates the signal arm direct. This arm in its normal condition is at "danger," and when the electric current is running through the magnet and is in work, the arm is pulled down, giving the signal "line clear." It can be held down in that or any intermediate position for any length of time with an almost infinitesimal consumption of current, namely, 0.16 ampère. If, however, any rod or wire is broken, or if anything goes wrong with the apparatus, the signal arm instantly flies up to "danger." At this point, and under all circumstances, there comes into operation another ingenious device which is due to Mr. Timmis. This is a simple locking bar so arranged as of itself to automatically and mechanically lock the signal at "danger," and to retain it there until released by the electro-magnet, or, in the case of accident to the gear, by some extraneous means. The signals, together with the points, are worked in the usual way from a signal box, although the details of the apparatus differ from that in ordinary use; the whole, however, forms a very complete and compact arrangement. The batteries are also placed in the signal box, those used at Gloucester being the Faure-Sellon-Volckmar accumulators. Primary batteries, however, can be employed, although it is stated they are less economical than secondaries. The signals at Gloucester form a complete set, consisting of a distant signal, arranged to be equivalent to a distance of 1,000 yards; home signals and junction and starting signals, controlled by the station in advance, and rail treadles, point and signal levers interlocking one with another. The system has been in work for the past two months, and has been operated under every possible condition, including the recent gales, during which it was worked with the low power we have indicated. It is already under trial on the London, Brighton and South Coast Railway by Mr. Haughton, the company's engineer, as well as by the Swansea Dock and Harbor Board in connection with their system of railways, and it promises to mark a new era in railway signaling.—*Engineering Review.*

Electric Smelting Plant.—The Cowles Electric Smelting and Aluminium Company, of Cleveland, with a capital stock of $200,000, was incorporated at Columbus recently, with Edwin Cowles, Eugene H. Cowles, Charles Fellabery and W. B. Hale as principal incorporators. The object of the company is the extraction, by means of electricity, of aluminium on a commercial basis.

The Western Electric Company's Lighting System.

It is not alone in the fields of telegraphy and telephony that the Western Electric Company has made its mark, although either of them would be quite sufficient to tax the energies of the most active individuals and corporations. In the sphere of electric lighting the company has made a number of improvements, and its system, which we have the opportunity of describing to-day, possesses many features of excellence deserving consideration. We are indebted to the company for the explanation herewith given in regard to the details.

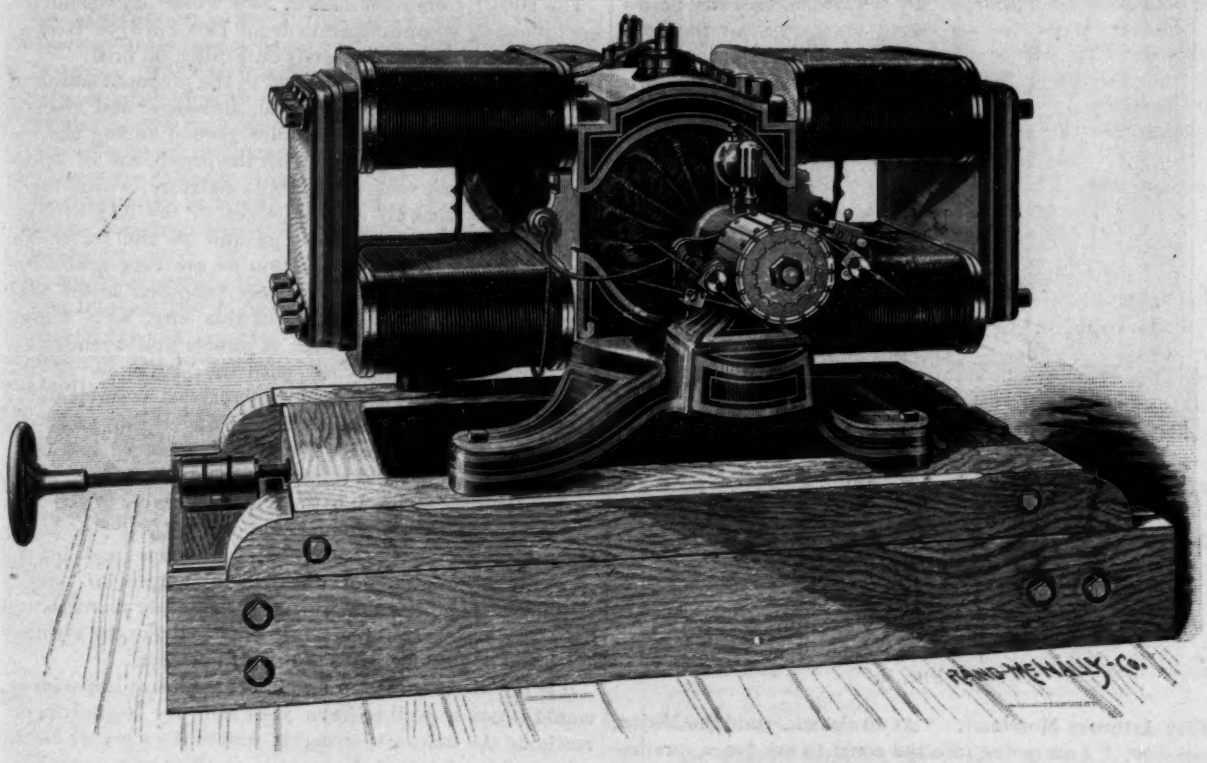


FIG. 1.—THE WESTERN ELECTRIC COMPANY'S DYNAMO, SIDE VIEW.

The dynamos, Figs. 1 and 2, are of a compact pattern, with specially constructed drum armatures built up of annular iron discs, eight or ten in number, placed together so as to polarize and depolarize readily without heat. Between the sections are interposed insulating strips of asbestos. The sections are supported on parallel bars running lengthwise of the armature core, and so arranged that they may be drawn radially from the shaft until they support the rings concentrically. The rings are insulated from the bars by interposed asbestos strips. The bars are also insulated at each end from the supporting slings.

The armature shaft is provided with three spiders of brass having four radial arms, which support brass rings provided with lugs between which the coils of the armature are wound. These brass rings also serve to support the parallel bars and core.

In winding, the armature is divided into a number of coils. Number one coil as it is wound fills entirely one of the spaces on one side of the armature, but instead of running to the space diametrically opposite, it is placed in the two spaces adjoining that space on either side, and fills each of these spaces half full. This completes the winding of one coil. The second coil is begun at the section diametrically opposite to the first, and, spreading, occupies half of each of the sections adjoining the first section.

The same method is pursued throughout and, effecting a spread of the coil on one side of the armature and an overlapping on the other side, secures a nearly neutral position of the coil, in passing from one magnetic field to the other.

This construction secures clean running, or freedom from sparks at the commutator, and permits any number of lamps being run on the machine by a simple movement of the brushes backward or forward.

From this method highly economical results on any number of lights are obtained. Destructive or damaging heat under all circumstances is avoided, and the machine can be run even on short circuit (all lamps switched out) without injury.

The freedom from sparks permits the use of oil on the commutator, thus reducing the wear to a minimum.

The field-magnets are constructed with a view to securing a seat for bearings and pole-plates at the same time. The bearings are plain and the device is so simple that it cannot be put together wrong if taken apart. The removal of a single cap screw is all that is necessary to begin the process of taking apart.

Accompanying the dynamo is a regulator by means of which the current is regulated to the resistance of the circuit, automatically increasing or decreasing according to the number of lamps thrown on or off.

It is self-adjusting to changes and indicates the same to the attendant.

An electric light switch-board (Fig. 3) enables the attendant to switch together any number of circuits or dynamos, or to switch any dynamo on any circuit, and at the same time protects the attendant from contact with the conductor, precluding all possibility of shock.

The dynamos are mounted on a compact, strong sliding carriage, adjustable for tightening the belt if necessary when running.

The Western Electric Company's arc lamp (Fig. 4) differs in internal construction and operation from that of any other system. Undue complication is avoided and the working parts are reduced in number, simplified in form and so arranged as to reduce the liability to derangement from wear, corrosion, dust or other causes, and at the same time to secure a very perfect regulation of arc resistance and current strength, thereby maintaining a steady and uniform light.

In its construction two electro-magnets of the ordinary form are used, having armatures attached directly toward their poles. One of the electro-magnets is wound with coarse wire and placed in the main circuit, the other with fine wire and placed in a circuit shunting the arc.

The main circuit magnet when energized establishes the arc by means of a lever working over a fulcrum, supported by an adjustable spring, and is opposed by a spring that serves to effect the current regulation, and avoids the necessity of a current regulator at the dynamo to accomplish this. To the spring-supported fulcrum of the main circuit magnet-lever is attached, by means of a lever, an armature that is attracted by the magnet in the shunt circuit, and which changes its position as the magnetic strength of the magnet rises and falls, thereby maintaining a uniform arc resistance, finely regulated feed of the carbons, and consequently steady light. The lamp is cut out by an automatic cut-out as soon as any defect occurs in the carbons, etc.

A double carbon lamp, Fig. 5, is also used, supplied with two sets of carbons, so arranged as to shift from one to the other automatically the instant the first set is consumed. The second set is held free from feed mechanically while the first is burning, and *vice versa*.

A very neat lamp-post, Fig. 6, is furnished when desired, so constructed that no additional frame is required to support the lamp. The post is made hollow and designed to carry the conductors on the inside when necessary.

A most convenient drop-hanger (Fig. 7) is provided, arranged to raise or lower the lamp without counterbalancing weights. It is quite simple, and consists of a roller having its central part reduced in diameter, upon which the winding cord rolls. A ratchet wheel and pawl is arranged to be thrown out of engagement with the wheel by the winding cord whenever a strain is brought on the cord, either in raising or lowering the lamp. Conducting cords pass around the outer end of the roller, to which the lamp is attached, and permit ready adjustment to any desired height, or lowering to recarbon. By this method of hanging, all danger of dropping incident to a break in the cord is avoided. The workmanship and finish is throughout of superior character.

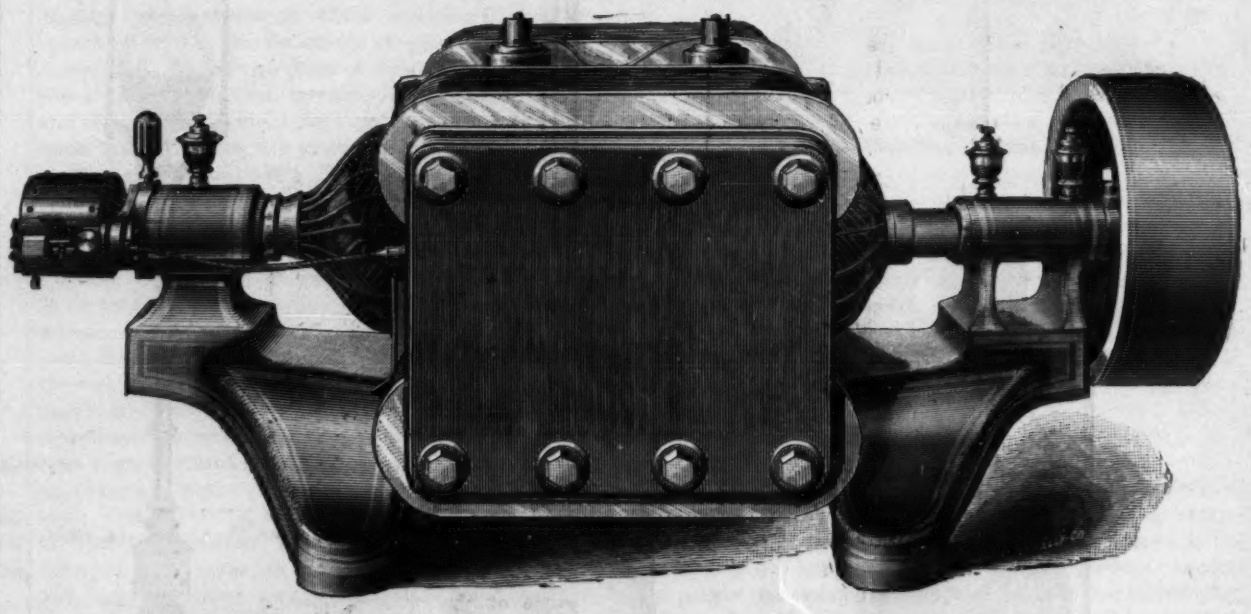


FIG. 2.—THE WESTERN ELECTRIC COMPANY'S DYNAMO, END VIEW.

Polar Earth Currents.

Some interesting observations have been made at the German polar station of Kingawa, says *Engineering*, on earth currents in high latitudes. In 1882, at the St. Petersburg conference, it was agreed to admit observations on telluric currents, and their connection with magnetic and auroral effects, into the programme of the polar observatories; and soon after Messrs. Siemens and Halske, of Berlin, the well-known German manufacturers, furnished the German polar expedition with twelve kilometres of light single wire cable, a mirror electro-dynamic, an aperiodic, and an astatic galvanometer, together with resistance boxes and batteries. In January, 1883, this cable was laid on the ice of the fjord, near the station, in a circle or loop, the ends being brought into the observatory. The surface inclosed by it was 7.889 square kilometres; calling E the electromotive force, F the extent of the circuit, y the vertical intensity of magnetism, and t the time, we have $E = F\frac{dy}{dt}$. Then if we know the variations of y, we can calculate the intensity of the induced currents in the cable. But this was found impossible by the German observers, because the apparatus to determine the vertical variations differed much in the results which they registered. They were two iron induction variometers of Lamont, and a Lloyd balance. The first marked a variation ten times greater than that marked by the balance. Hence the observers were obliged to form an opinion on the variometers from the currents in the cable, instead of calculating these currents from their indications. The exactitude of the Lloyd instrument was thus proved, and the cable with a galvanometer in circuit found to be a good indicator of the variations of vertical magnetic intensity, with this drawback, that it only registered the speed with which they changed, not the values themselves. In taking the three intensities of the current obtained by estimation for the time between two readings of the instrument, they calculated the mean intensity for each half-minute during the duration of the observation, and they afterward compared that intensity with the movements of the Lloyd balance according to the formula $b\,i = \Delta\,\mu$. From b can be calculated in degrees of the galvanometer the intensity of the current in the cable, if the vertical intensity changes with a given speed. On the other hand, this change of electromotive force in the cable is given in an absolute manner by the equation $e = F\frac{dy}{dt}$. If the sensibility of the galvanometer is known, the resistance of the cable can also be expressed, or, in other words, the value of the true ohm can be found from the factor b. This new method of determining the ohm, in which a single loop circuit extending over a large area takes the place of a small coil of many turns, is worthy of attention. Deposited on dry ice, its insulation would be enormously high.

Broken Cables.—It is stated that the Anglo-American Western Union broken cables have not been repaired as reported sometime since, and the work has been abandoned until more favorable weather.

Fighting for the Poles.

Pittsburgh has been enlivened by a bitter struggle between the Western Union and the Western Pennsylvania telegraph and telephone companies for the use of certain poles in that city. A dispatch of April 4 from Pittsburgh says:

Since last Tuesday morning, when the Western Union linemen cut the wires and tore down the cross-arms placed by the Western Pennsylvania Telegraph Company on the poles on Liberty street, between Fifth and Eleventh streets, there has been a cessation of hostilities between the rival companies. Although the Western Union Company maintained a patrol guard night and day to keep their rivals from stealing a march upon them, this morning the truce came to an end and a determined struggle was begun for the possession of the disputed poles. Shortly before 7 o'clock a large force of Western Pennsylvania linemen, equipped with ladders and other necessary apparatus, started out at Fifth street and began to replace the obnoxious cross-arms. The Western Union guards were not to be caught napping, however. Word was instantly dispatched to the officials, and they were soon on the ground with all the linemen and employés they could muster for the emergency. As fast as the poles were abandoned by the Western Pennsylvania men they were mounted by Western Union men with saws and nippers, the replaced wires were cut and the cross-arms sawed in two. A man was stationed on top of each pole to hold the fort until further orders. As soon as the Police Department was apprised of what had been done Chief of Detectives Roger O'Mara was dispatched to the seat of war with a posse of thirteen policemen. The officers arranged themselves along the line, one at each pole held by the Western Union men. The name of each of the "roosters" was obtained and telephoned to the Mayor's office, where warrants were at once made out and served. The first warrant was served on a tall, lank specimen of humanity who was perched on a pole near the corner of Liberty and Seventh streets. When the officer read the order of arrest at the foot of the pole the sagacious lineman feigned deafness. The "bobby," not to be foiled, shinned up to the dizzy altitude of the severed cross-arm and served the warrant in person. Two more arrests followed in the same vicinity, but as fast as one lineman was removed another took his place, and warrants could not be obtained fast enough to keep the poles clear.

Superintendent Duncan, of the Western Pennsylvania Company, said: "The fight is not ours, but rests between the city and the Western Union Telegraph Company. The question to be decided is whether or not that corporation owns the city of Pittsburgh. We are acting under instructions of City Attorney Moreland, who directs us to place the arms and string the wires at all hazards, and we propose to do so. As fast as the Western Union pull our wires 'down' we will replace them, until otherwise ordered by the City Attorney or the courts. There are twenty-five poles in dispute, extending from Fifth to Eleventh along Liberty street."

A Western Union official said: "The poles are ours to do with as we please, and the city has no right either to place the wires itself or to order a rival company to do so. We have possession now and propose to keep it."

"What do you propose to do about it?" was asked of

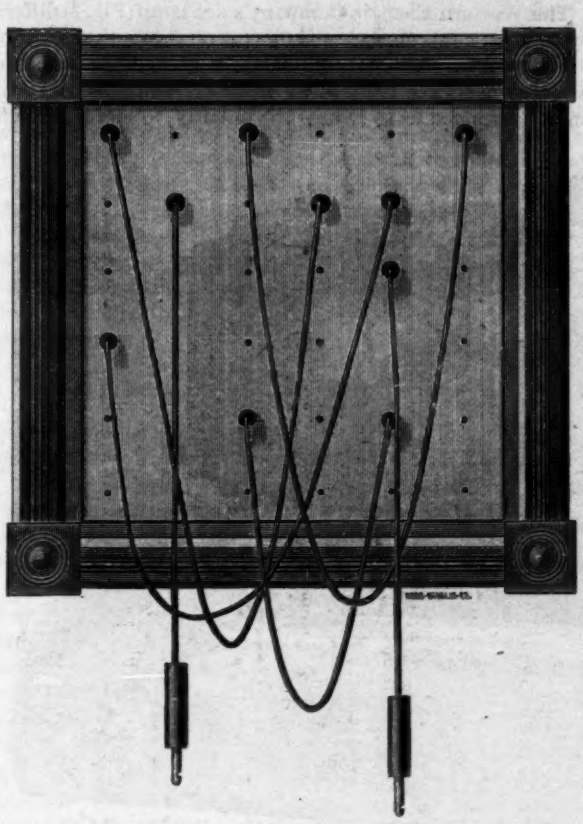


Fig. 3.

City Attorney Moreland. "At 10 o'clock," said the Major, suavely, "I am going into the court to ask for a preliminary injunction. I think there is no question that the poles belong to the city, for whom they were originally planted. The Western Union Company may have replaced any or all of them, but this does not affect the city's title." At 10 o'clock the Western Union Company were in possession of all the poles between Seventh and Eleventh streets, and the Western Pennsylvania Company of those between Fifth and Seventh streets.

While Major Moreland was talking about getting out an injunction in behalf of the city Messrs. Hampton and Dalzell stole a march on him by obtaining one from Judge Stowe restraining the Western Pennsylvania men from taking further steps to secure the poles until the matter in dispute was legally settled. After the injunction had been granted the Western Union linemen were ordered to leave their aerial posts. Before a deputy sheriff could serve notice on the Western Pennsylvania Company their linemen were in possession of the disputed poles and stringing wires to connect engine houses Nos. 1 and 3 with the central office. Shortly before 11 o'clock, however, the sheriff's representative appeared on the ground and stopped the work.

Sanitary Objections to the Underground Law.

The Health Commissioners of New York City considered the following communication from Drs. Fordyce Barker, A. L. Loomis and H. B. Sands on Friday, 3d inst.:

"Our attention has been called to the proposed action of the various telegraph, telephone, messenger and electric companies for placing wires under ground during the ensuing season, in compliance with the provisions of a law passed at the last session of the Legislature, which made it compulsory that all electric wires in the city of New York should be placed under ground by the 1st of November next. In this connection we are very much impressed with the bearing that this proposed action may have upon the public health of this city, as a simultaneous tearing up of the various streets and avenues for the purpose of complying with the provisions of the above law will, in our opinion, be very detrimental to the health of the city, inasmuch as the underlying structure of our streets is composed of material more or less saturated with coal gas and other noxious gases, which, when let loose, will contribute to the unhealthfulness of the city.

"We are more apprehensive on this subject just at the present season than possibly at any other time, for the reason that we may not unreasonably expect to have a visitation of cholera here during the summer months, and the above result would certainly tend to make the sanitary condition of the city more difficult to perfect.

"If the above is in your opinion of sufficient importance, would it not be well to have your sanitary inspectors investigate the matter thoroughly and make a report on the subject, in order that the public, at all events, may have all the facts before them bearing on this subject before action is taken, which, we are informed, will probably be as soon as the frost will allow the work to be commenced on the streets."

The board adopted resolutions that while an ordinary excavation for laying a gas or water pipe would not be a source of danger, the scheme for placing the telegraph wires under ground comprehended excavations that would prove highly detrimental to the health of the city, as would any extensive excavations of the streets, as they would expose to the atmosphere subsoil saturated with noxious gases. In the opinion of the board, it would be wise during the approaching summer to avoid as far as

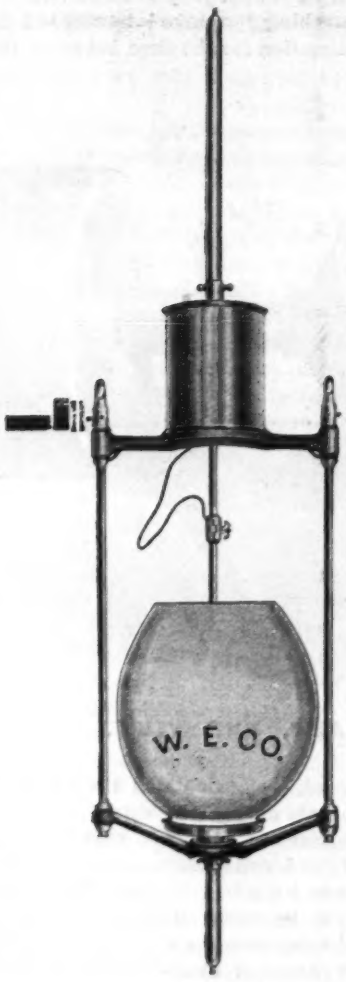


Fig. 4.

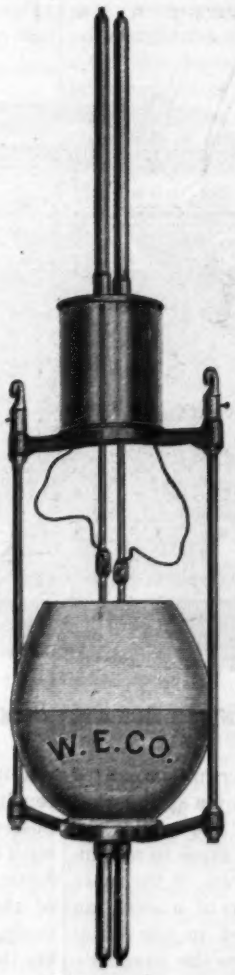


Fig. 5.

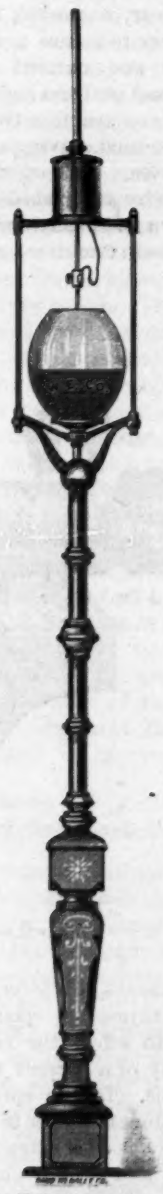


Fig. 6.

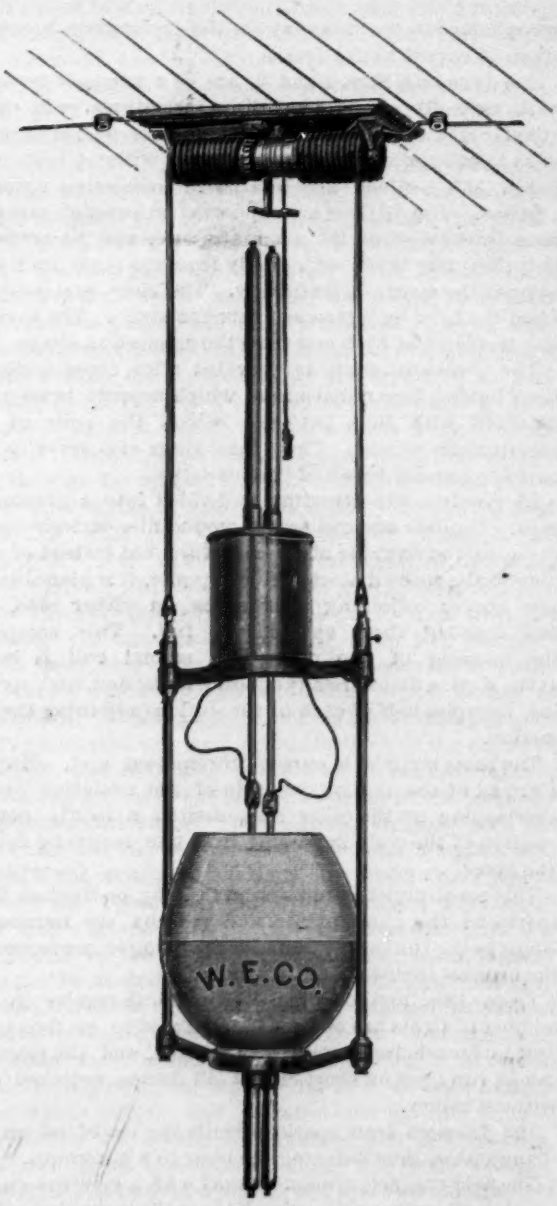


Fig. 7.

THE WESTERN ELECTRIC COMPANY'S ARC LAMPS.

possible making any street excavations not imperatively needed by the exigencies of the public service. It was also resolved that the mayor and the heads of the various public departments be furnished with a copy of the preamble and resolutions, and that they be requested to limit street excavating to between Oct. 1 and May 1, especially in the thickly settled parts of the city.

Two New Sensitive Galvanometers.

It would appear difficult to conceive of a galvanometer more delicate than Sir W. Thomson's, yet two instruments have recently been produced which exceed that in sensitiveness. The two instruments described below present a certain analogy with respect to the form and disposition of the needles employed, but it is interesting to note that the effects are produced by methods of winding the coils that differ radically from each other. Thus, while one has but two small coils with a resistance of only 30 ohms, the other employs four coils, aggregating more than 30,000 ohms.

The first of these instruments, which is shown in Fig. 1, was devised by J. Rosenthal, and is remarkable for its simplicity and convenience of handling. The arrangement of the apparatus is shown in perspective in Fig. 1, and Fig. 2 shows a section, exposing the needles and coils. The instrument rests upon a marble base, provided with leveling screws, and on the former are mounted two columns *m* and *n*, which keep the plates *i* and *k* in position. The damper *d*, Fig. 2, rests upon the plate *k*, and is held in position by the clamping-screw *q*, which

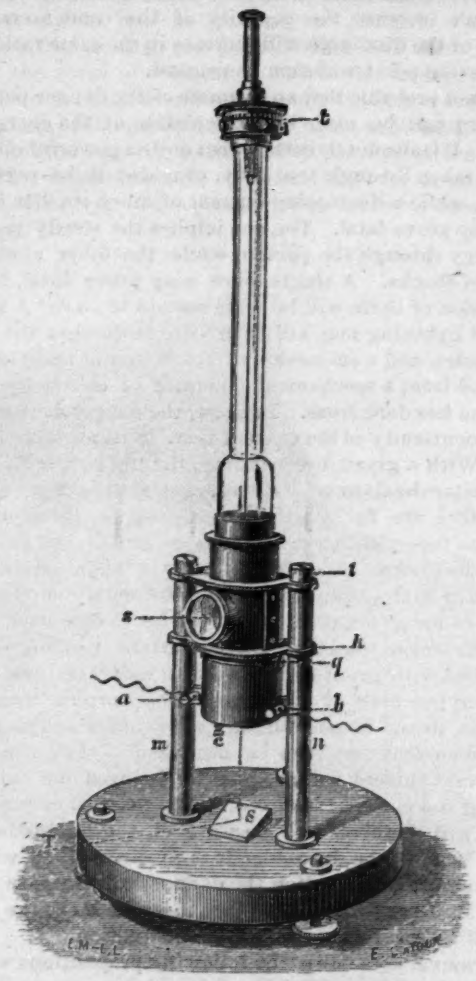


FIG. 1.—ROSENTHAL'S MICROGALVANOMETER.

enters the groove *u*. The binding screws *a* and *b* are connected with the terminals of the coils.

The mirror is suspended in the apartment between *i* and *k*, which consists of two semi-cylindrical sections which can be revolved. The suspension tube is screwed to the plate *i*, and has a torsion head *t* at the top.

The needle consists of a small magnet in the shape of a horseshoe *h*, the ends of which are bent at right angles so as to form the horizontal projections *x* and *y*. These little projections constitute the poles of the magnet upon which the directive influence of the coils can take effect, and they form quadrants of a circle, the centre of which lies in the vertical axis of the horseshoe, the projections passing freely through the cores of the coils *r*, *s*. These little coils are composed of 200 convolutions of insulated silver wire 0.05 millimetre in diameter, wound upon ivory spools. The latter are sunk half-way into the ivory support *w*, which also carries the binding screws *a*, *b*. The support is in the shape of a rectangular prism, and is let into two slots in the copper damper *d*. The prism is held in position by the glass plate *p*, which is clamped by three screws *c*, and closes the lower end of the damper. The latter consists of a thick cylinder of copper, bored out to accommodate the needle. The mirror *s* is placed above the needle and both are suspended by a fibre of silk.

The adjustment of the instrument is as follows: The marble base is first leveled by means of the leveling screws and the glass suspension tube screwed on. After the silk fibre has been introduced into the latter the magnetic needle is hung on and raised until the mirror stands between *i* and *k*. The copper damper is then placed in position, but without the coils and glass plate, and the spot of light is then brought to the centre of the scale. The damper is now revolved until the slots form an angle of 45 degrees with the ends of the small pole pieces. The prism carrying the coils is then inserted and held in position by clamping on the glass plate *P*. Finally, the damper is revolved until the curved pole pieces *x* and *y* swing freely within the cores of the coils, which operation can be assisted by raising or lowering the fibre and by a slight readjustment of the scale. These operations are greatly facilitated by placing a mirror *S* under the

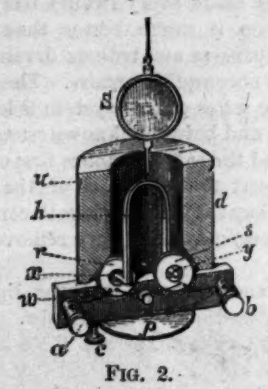


FIG. 2.

damper, since by looking in the direction of *T* the whole interior of the instrument becomes visible.

The following are the principal dimensions of the instrument:

Height over all	460 mm.
Height of suspension tube	255 "
Height of damper	39 "
External diameter of damper	39 "
Internal diameter of damper	20 "
Height of horse-magnet	27 "
Weight of horse-magnet with mirror	4.3 gr.
External diameter of coils	12 mm.
Thickness of coils	3 "
Diameter of core of coils	5 "
Resistance of both coils	30 ohms.

The sensitiveness of the instrument is shown by the following experiments made with it:

Without Compensating Magnet.

0.1 mm. deflection on a scale placed at a distance of 2,700 mm. = 0.000,000,005,4 ampére.

With Compensating Magnet.

0.1 mm. deflection = 0.000,000,000,12 ampére.

A thermo-electric battery, the elements of which consisted of German silver and iron, at a difference of temperature of 10° C. gave a deflection of 120 mm., on the same scale, with 1,000 ohms resistance in the circuit.

Fig. 3 shows in elevation and horizontal section the coils and arrangement of needles adopted in an instrument of very great sensibility constructed by Messrs A. & T. Gray, and described in the *Proceedings of the Royal Society*. The instrument, which was used in their experiments on the electric resistance of glass and allied substances, consists of two pairs of coils *c*, *c*, *c*, *c*, with hollow cores, arranged so that the axes of each pair are parallel and in a vertical plane. Each pair is carried by a vertical brass plate, and the two plates are inclined to one another at an angle of about 106°. Thus, the vertical planes containing the axes of the coils are inclined to one another at an angle of 74°. Two horseshoe magnets *m*, *m*, made of steel wire about 1 mm. in diameter, are connected together by a very light frame of aluminium, and are at such a distance apart as to hang, when the needle system is in equilibrium, with no current in the coils, freely within and nearly along the axes of the cores of the coils. The horseshoes are not plane, but are bent round so that they form approximately portions of one vertical cylinder of which the suspension thread is the axis, and to which the axes of the coils form horizontal tangents near their middle points at approximate positions of the poles of the needles. This form was given to the needles to lessen the chance of their extremities coming into contact with the sides of the cores in the case of large deflections. The diagram shows clearly that, since it is advantageous to have the cores of the coils as small as possible, it is necessary to curve the needle. The needles are at present

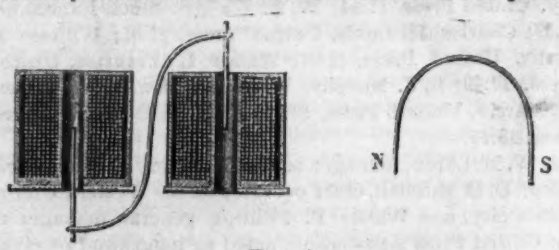
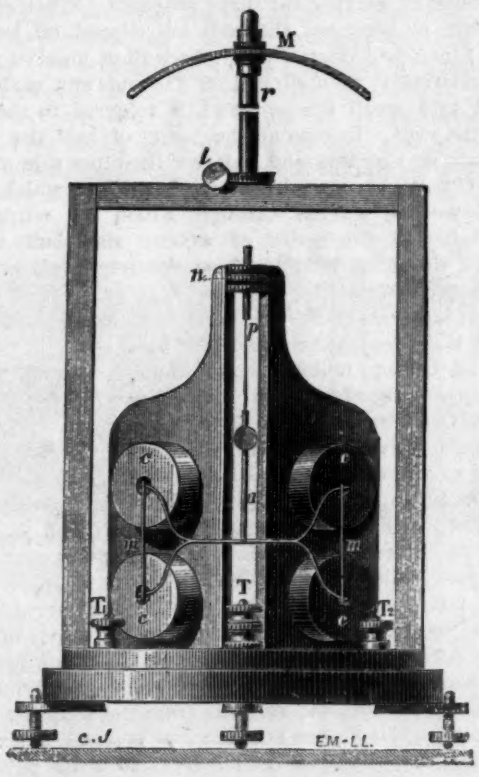


FIG. 4.

arranged with their unlike poles turned in similar directions, and are hung by a single fibre of unspun silk from the square screw-pin *p*. A nut *n* working between two fixed projecting pieces raises or lowers *p*, and, therefore, affects the needles similarly, without giving any twist to the thread.

The four coils are at present arranged in series, and have a combined resistance of 30,220 ohms made up of 5,392 yards of copper wire of No. 50 B. W. G., laid on in 62,939 turns in all, approximately equally divided among the four coils. A distributing plate admits of ready joining of the coils in such a way as to diminish the sensibility or resistance of the instrument. When a current is sent through the instrument, the poles of one horseshoe are pulled farther into the corresponding coils, and the poles of the other horseshoe are pushed out of the coils. A couple tending to turn the system as nearly as may be round the axis of suspension is thus applied; and a mirror attached to the upright piece of aluminium *a* reflects a beam of light to a scale in the usual manner, to give a means of measuring the deflection. According to one arrangement of the instrument, the magnet *M*, carried in a horizontal position by the brass rod above the needles, used to give a return couple, and to control the zero conveniently, can be turned in azimuth by means of the tangent screw *t*. The instrument is fitted with three measuring terminals, *T*, T_1, T_2, so that it can be used as a differential galvanometer. These terminals and connecting wires are carefully insulated by vulcanite. As thus arranged, this instrument can easily be given a sensibility so great as to show a deflection of one division (½ millimetre) on a scale at a distance of rather more than a metre, with one Daniell's cell and a total resistance of 10^{11} ohms in direct circuit; a degree of sensibility which could not be reached with the most sensitive astatic instruments as ordinarily constructed. With special adjustments of the needles, still finer sensibility can be obtained, but the period of oscillation of the needle becomes then so great as to be troublesome when results are required with rapidity. The investigators have found it very convenient in their experiments on the resistance of glass at different temperatures, in the course of which, though not arranged for very high sensibility, it has been used with a battery



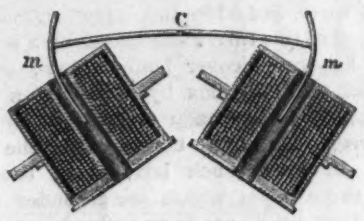


FIG. 3.

of about 120 Daniells to measure resistances from 10^4 to 10^5 megohms. To increase the rapidity with which observations are taken, the instrument can be fitted with a vane immersed in a liquid, or placed in a nearly closed air-chamber of proper dimensions. In another form of the instrument, Fig. 4, of which an example is being completed for Sir Wm. Thomson for use as a ballistic instrument, the four coils are arranged symmetrically in one plane, and a horizontal curved (slightly S or Z-shaped) bar or frame of aluminium is used to carry the vertical horseshoes. This frame passes through from one side to the other of the plate carrying the coils, so that one horseshoe enters its pair of coils from one side, and the other horseshoe its pair of coils from the other side. The coils are joined so that when a current is sent through the instrument both horseshoes are dragged further into their coils, or both pushed out at the same time. The needle system is thus turned round the suspension fibre, and the deflection is measured by means of a mirror and scale as before.

Attempted Assassination.—An attempt to assassinate Mr. Geo. L. Masters, manager of the Telephone Exchange, was made yesterday, says the Evansville (Ind.) *Public*, of April 1, and for a time there was much excitement in the neighborhood of his office. Mr. Masters had been seated at his desk, and had just risen to answer a telephone call when a shot was fired through a window, passing within less than a foot of him. The ball passed through a glass partition separating his office from an adjoining room, and deeply imbedded itself in the wall beyond. The scoundrel immediately fled and, though pursued, managed to make good his escape. Mr. Masters has no suspicion as to the identity of his would-be assassin.

The Electric Tube Company.*

Statement of the Company—edited by the Examiners.)

(CONCLUDED.)

A distinct variety of electric tube is that designed for telegraphic and telephonic use. In this case, the conductors being many in number and small in size, instead of the spiral rope winding round each conductor, the insulating covering is continuous, and a rope winding is only used round the outside of a bundle of such wires. The wires are laid together regularly, on the basis of a hexagonal cross section for the bundle, and at each end are threaded through wooden screens which have holes drilled in them, in the same relative positions as the wires occupy in the tube. At one end of each tube, before being threaded through the screens, the wires are woven together so as to change the relative positions of the wires. This operation of weaving is simple and systematic, and the same for all tubes with the same number of wires, and is arranged on such a basis that in conjunction with a systematic rotation of consecutive tubes, alternately to right and left, in the process of laying, it produces, in a series of long period, methodical changes in the relative positions of the wires in consecutive tubes, for the purpose of neutralizing the effects of induction. In making the joints of these tubes, wires threaded through corresponding holes in the screens are bent outwards and placed together in the same notch of a series of notched wooden slats, one for each layer of wires in the joint, which are built up one above the other, as the process of making the joint proceeds. When all the wires are so bent out, the ends are clipped off, leaving about 1 inch projecting through the wall of notched slats; the insulation is then slipped off the ends and each pair joined by a small sleeve, which is soldered to them to make the joint. In general, the joints of half the wires are made on one side and half on the other side of the box. Grooves are provided in the boxes into which they fit the wooden screens through which the wires are threaded, and the series of wooden slats built up in making the joint holding these securely in place. By this method of making the joints, every joint of every wire, at intervals of 20 feet, is brought into a position in which it is readily accessible for purposes of testing, making connections, etc., without interfering with any other wire, so that at any such joint, loops or single service wires may be attached to any or all of the wires in the line. A line of this character, containing 37 wires, was exhibited, with several consecutive boxes and joints to show the system of weaving wires in conjunction with alternate rotation of tubes. Such a line is adapted more particularly to telegraphic uses. Another box was exhibited, constructed with especial reference to the needs of telephone service, for which, in addition to trunk lines between stations, a number of wires are required for services in each block, and only run from the station to that block, thus giving a line between two stations a size decreasing gradually from each station to some point between them. The box exhibited, which showed a joint in a line of 217 wires, had a low turret rising from its upper half. The top of this turret was closed by a loose outside cover and an inside cover bolted down, and making a tight joint with the box by means of a rubber gasket, the whole being made water-tight by filling the space between the two covers with the insulating compound. In every such box, along the face of a block, all those wires which are intended for use as services in that block are bent upwards instead of outwards, in making the joint, so that the joints of all such wires project upwards into the turret and are held in position by a wooden frame shown, whilst the joints of all other wires are made out to the sides at a lower level. This arrangement allows the box to be filled with insulating compound, covering all the wires and all joints, except the joints of those wires intended for use in that block, which latter joints project up above the surface of the compound, and on removing the cover of the turret are all immediately accessible at every box along the block, for attachment of services to any or all of them. Tapped holes are provided around the turret on the level of the joints of service wires, into which service tubes may be screwed, if electric tubes are used, or brass nipples to which are soldered the lead covering, if lead-covered wires are used for service connections.

This company also exhibits specimens of lead-covered wires of small sizes, and a specimen of flexible heavy conductor for indoor use with large currents, consisting of copper wire rope, taped, wound and lead-covered. They also exhibit specimens of insulating tape, in rolls of 125 feet, continuous length, varying in width from 6 inches to ¼ inch, and jars of the insulating compound used in the tubes and boxes.

Comments by the Examiners.

This system may be summed up as belonging to division "A a" of the section's arrangement, or that in which the electrodes are permanently sealed. When any portion of an electrode is destroyed a new one is not introduced, but a new length of pipe is substituted, containing the necessary number of wires and attached at its extremities. The details are very fully given, and with the cuts render it unnecessary to repeat them. With a large stock of lengths and boxes, and with trained workmen, the work of laying the conductors only a few inches below the surface of the streets would be comparatively rapid. While in the tentative stage of underground service this does not present the same amount of convenience as a system where wires may be introduced and removed at will, and presents the objection common to all "section" systems that the conducting capacity of the whole line is that of the most imperfect of splices made every twenty feet; yet it answers the demands upon it much better than those systems which require expensive and tedious derangements of the street in order to accomplish repairs. The seat of an accident to one of the wires of this system is located from the central office, on and between known streets. The manhole is opened and the safety catches first of all examined. The managers assert that the place of the break can then be so accurately located that the length containing it (usually about 20 feet) may be at once removed and replaced by another.

The telephone and telegraph and the light and power wires are not inclosed in the same tube. The insulating material with which the boxes are filled is still flexible at 32° F., but brittle at 0° F.

The method of laying and tapping for private dwellings would seem to afford complete protection against lightning. The three-wire system which has been grafted upon the Edison conduit system effects a saving of 62 per cent. on that required for the 2-conductor system, in the copper necessary for conductors.

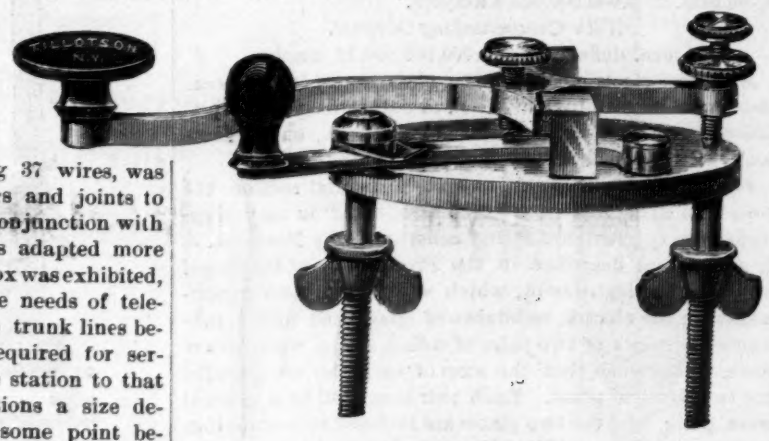
The light and power systems are not adapted for use by various companies, independently, though the telephone and telegraph conduits might be so applied.

The details of this system have been so perfectly elaborated, that in view of the fact that no complete description of it has been heretofore made public, the examiners deemed the above full report desirable.

* Report of Board of Examiners, Section 18, Underground Conduits, International Exhibition, Philadelphia.

Fast-Sending Contest.

A contest of skill in telegraphing was participated in on April 5, by a dozen operators at the local receiving rooms of the United Press Association, under the management of Fred Catlin, chief operator of the Western Union at 195 Broadway. The number of words transmitted was 500 comprising, with punctuation marks, 2,368 characters. Speed and excellence, or the best combination of the two, were to determine the winners. The first prize offered was $25 in cash, a badge, or value of prize in electrical instruments, at the option of the winner, presented by L. G. Tillotson & Co.; second prize, $15 in cash, a badge, or value of prize in electrical instruments; third prize, $10 in cash, a badge, or publications, at option of winner, presented by W. J. Johnston; fourth and fifth prizes, $10 each, presented by the United Press Association. The time made was: J. W. Roloson, Stock Exchange, 10:32; Frank J. Kihm, United Press, 10:38; William Gibson, Stock Exchange, 10:57; M. J. Doran, Bennett & Co., 11:26; John G. McCloskey, United Press, 11:44; W. L. Waugh, Stock Exchange, 11:57; Charles H. Davis, United Press, 12:01; William J. Curtis, United Press, 12:27; Walter L. Prentice, United Press, 12:49; R. J. Murphy, Western Union, 12:51; Robert W. Martin, United Press, 12:51; F. G. P. Griffith, United Press, 13:15.



THE VICTOR KEY.

J. W. McLaren, manager of the Baltimore & Ohio's local office; D. B. Mitchell, chief operator of the Western Union, in this city, and Walter P. Phillips, general manager of the United Press Association, acted as judges and received the messages sent on a local wire in an adjoining room. The first prize was awarded to J. W. Roloson, for great speed and remarkable clearness, considering the time made; second prize to William Gibson, for unusual speed and pronounced excellence; third prize to Frank J. Kihm for remarkable speed, marred by faults in the formation of characters; fourth prize to William J. Curtis for absolute correctness, speed and beauty of style; fifth prize to F. G. P. Griffith for speed and excellent manipulation with the left hand. The contest was the third ever held in this city and the time made beat previous records. The first match took place in 1881, when the best time, 11:10, was made by W. L. Waugh, who came out No. 6 last Sunday. The second contest came off in August of last year and the best three men were W. L. Waugh, 11:32; William Gibson second, and Frank J. Kihm third. We give herewith a cut of the Victor key used. This key is made by L. G. Tillotson & Co.

Dangerous Currents.

Considerable discussion, called forth by Prof. Dolbear's articles which appeared in our columns a short time ago, is now going on in relation to the cause of danger from electric currents. The question has been discussed from various standpoints and some interesting points brought out. In a communication to the *American Engineer* Prof. H. S. Carhart sums up the result of the discussion, and we extract the following remarks:

It is evident that safety is not determined by the electromotive force alone, without regard to other conditions; for a spark from a Holtz machine with an E. M. F. as high as 50,000 volts produces only a spasmodic jerk and does no injury; while d'Arsonval says that he has killed Guinea pigs with currents from a Gramme machine ranging from one to thirty ampères and from two to twenty volts. A Holtz machine provided with condensers of about 175 square cm. surface and a reduced thickness of one mm. in comparison with air, has a capacity at 50,000 volts E. M. F. of nearly eight millionths of a coulomb. The heat energy developed in the discharge of the condensers between the electrodes is 78×10^5 ergs, or 0.185 gramme-degrees. This result does not correspond with those of Professor Dolbear or Mr. Sprague, but the errors of these gentlemen are not difficult to make out. Such a discharge does not appear to represent sufficient energy to produce serious effects; but if we increase the capacity of the condensers, the energy of the discharge will increase in the same ratio and a dangerous point will soon be reached.

It is not probable that an estimate of the danger point of a current can be made by a calculation of the energy involved. It is absolutely certain that quite a powerful current can be taken through the body, provided it be perfectly steady, while a fluctuating current of much smaller intensity may prove fatal. The one implies the steady passage of energy through the person, while the other applies a series of shocks. A single blow *may* prove fatal, but a succession of them will be more certain to do so. A single flash of lightning may kill or in some cases char the body to a cinder, and a succession of a thousand or more shocks a second from a mechanical generator of electricity may prove no less dangerous. In short, the danger lies more in the discontinuity of the current than in its absolute intensity. With a given discontinuity, the higher the E. M. F. the greater the danger. Hence, also, alternating current generators are far more dangerous than those of the Gramme type yielding continuous currents. On this account the system of distribution by a main alternating current of high pressure, producing secondary currents by means of induction coils, is not to be commended, however efficient it may be. Direct current machines may be studied with profit by means of an induction coil consisting of two coils of stout wire. The current from the machine should be sent through the primary coil and the induced current may then be measured in the secondary. A constant current will produce an induced one only on opening and closing the circuit. The induced current obtained will therefore be a measure of the fluctuation of the E. M. F. in the dynamo. It is apparent that with a given range of fluctuation the danger will increase with the E. M. F., or that with a given mean E. M. F. the danger will be greater the greater the fluctuation.

D'Arsonval lays down the following propositions which are undoubtedly correct:

1. A battery and a machine producing in a rectilineal circuit two currents, having the same intensities and the same pressure, do not present the same dangers. The danger of the current produced by mechanical means resides simply in the power of the extra current resulting from the self-induction of the generator.

2. Two machines yielding currents of the same intensity and the same pressure in a similar circuit may be unequally dangerous, since their co-efficients of self-induction, and consequently their extra currents, may be very different.

3. A current not dangerous in one circuit may be dangerous in another. It is merely necessary to give the circuit a self-induction, by any means whatever—*e. g.*, by the interposition of an electro-magnet.

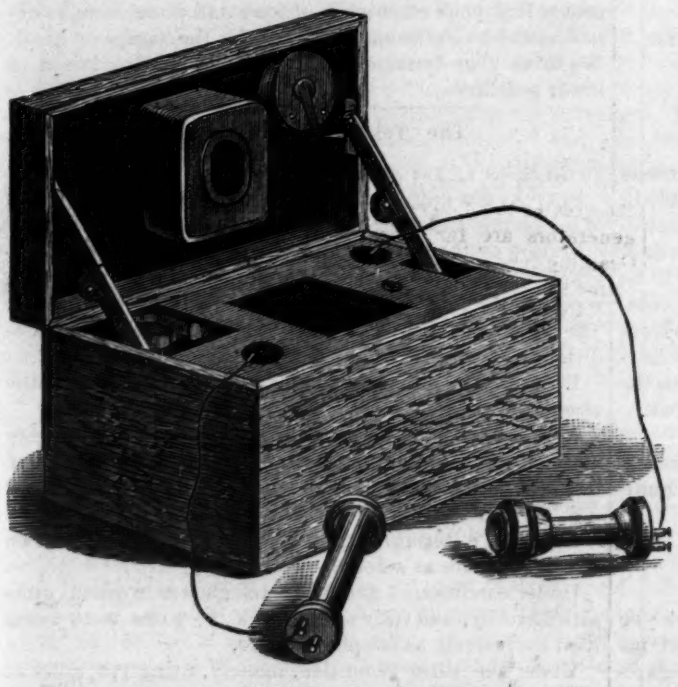
These propositions embody the truth, but not the whole truth; for these extra currents manifest themselves only upon opening and closing the circuit, or at least on increasing or decreasing the main current. This would not cover the danger arising from the discontinuity or fluctuation of the E. M. F. of the generator, and would not explain the fatal accidents that have arisen from mere contact with the conductors. To sum up the causes of danger, we may mention very high electromotive force, fluctuation or discontinuity of the current, and the extra currents arising from self-induction.

The resistance offered by the human body may sometimes determine the degree of danger attending contact with an electric circuit. Until within the last two years that resistance has been supposed to range from 10,000 to 15,000 ohms; but Dr. W. H. Stone, of St. Thomas Hospital, London, has shown that some persons present a resistance from foot to foot of only 500 ohms or less. Most of the resistance is at the contact with the skin; by soaking the

hands or feet in salt water and increasing the surface in contact with the metallic portion of the circuit, the resistance may be almost indefinitely reduced. Some of Dr. Stone's lowest results have been obtained with alternating induction currents.

The physiological action involved in death by means of an electric current has not yet been made out apparently. Dr. Stone has suggested "that actual catalysis or decomposition of the body is not impossible, and that probably thrombosis, or coagulation of the blood in the living vessels, occurs in other cases." On the other hand it appears that in the case of the man killed at the London "Healtheries," "the body speedily became discolored, rigor never set in, and this, coupled with the fact that the blood never coagulated, is in accordance with several authentic records, but at variance with Dr. Stone's suggestion." When the circuit was established through the man's arms and chest, there was a spasmodic contraction of the muscles in the path of the current, and subsequently the blood vessels in the same region were found to be highly congested, especially in the chest. The heart was *empty*. It seems entirely probable that the pneumo-gastric nerve was affected by the sudden shock, and this may have produced a stoppage of the heart's action.

The device of d'Arsonval to avoid danger is based on his theory that all danger arises from the high-pressure extra currents. These extra currents he seeks to suppress by placing in derivation at the terminals of the generator a series of voltameters, consisting of lead plates and acidulated water, in such number that their E. M. F. of polarization may exceed the maximum electromotive force of the machine. This derivation is then entirely impassable by the direct current, but the extra current passes it readily. The supposition is that the extra current will then pass through the series of voltameters, while the human body will be secure. This would seem hardly applicable in practice, because accidents occur rather upon accidental contact with the conductors without any opening of the circuit. The voltameters have the effect, however, of secondary batteries used in the same way to steady a current.



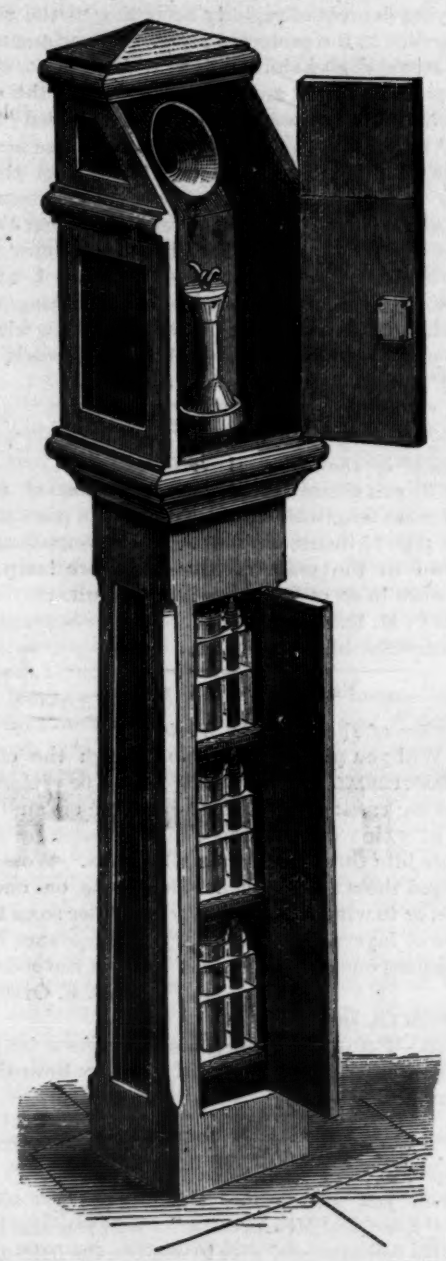
DIVER'S TELEPHONE.

They remove almost perfectly the fluctuations in the direct current, and therefore suppress the very characteristic of mechanically generated currents that makes them especially dangerous.

Telephone Manufacture in England.

The manufacture of telephones and telephonic apparatus in England is largely carried on by the Consolidated Telephone Construction and Maintenance Company, at their works in the Farringdon road, London. We give on this page cuts of three of their productions, and take from the London *Electrician* the following description of the plant and processes:

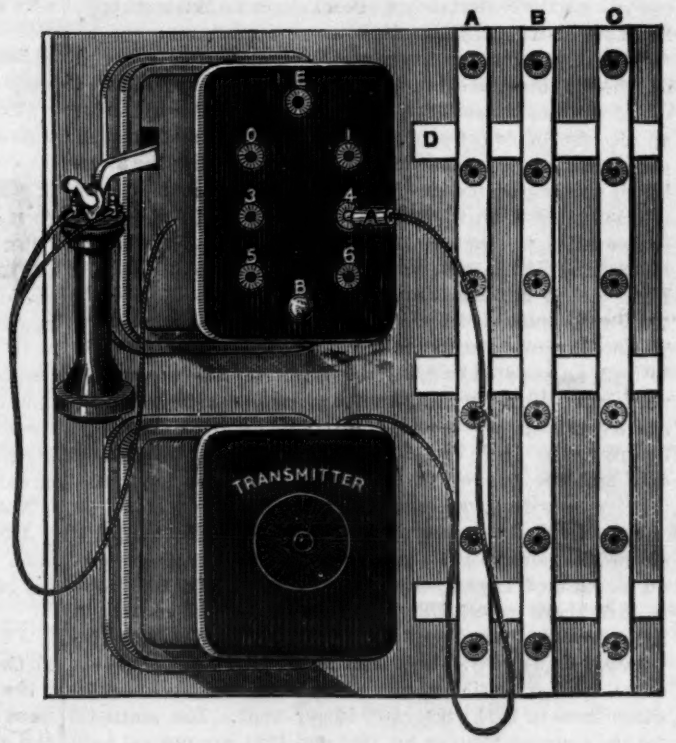
On the ground floor of the premises is the machine room, in which, in addition to a number of lathes, drill presses, etc., and a whole host of tools of every sort, size and description, we noticed, as exhibiting perfection both in design and workmanship, two screw-making machines, capable of manufacturing from 1,000 to 1,500 screws or terminals per diem; one making 4,000 to 5,000 small screws per diem; an automatic punch press to make 90 blanks up to 6 inches in diameter per minute; a punch press making 150 blanks per minute; an automatic tapping machine tapping from 30 to 50 holes per minute; and a universal index milling and gear-cutting machine, which seemed to be capable of making almost anything, from a toothpick to the most complicated forms of spiral gear. There, also, were horseshoe magnets for the magneto bells undergoing saturation at the rate of about two per minute, the current being supplied by an Edison Z dynamo, driven by a 60 horse-power Gwynne horizontal engine, which also serves six Thornton arc lights on the lower floor, and 220 twelve candle-power Edison incandescent lamps throughout the building. Another feature of interest was the process of depositing brass upon iron by electricity. We understand that the method is not very generally known. We can, however, testify to the excellence of the imitation, and the neat appearance of the screws and other constituent parts of the apparatus which were so treated. On the first floor we were shown the fitting room, where the thousand or more parts of the telephone, magneto-bell and transmitter were being pieced together by boys. This is but a simple operation, in that all the component parts are so accurately made by the machinery, are so mathematically exact in their proportions, and therefore fit so easily in their respective places, that their combination is a mechanical operation calling for the display of no other quality than that of attention. At a centre table was a member of the fair sex winding the coils of a magneto bell, an instrument capable of ringing through 30,000 ohms resistance; at others were skilled workmen soldering the platinum contacts to delicate springs, etc., while on every side were to be seen, in various stages of completion, large numbers of the Gower-Bell and almost every other form of telephonic apparatus which has successfully withstood the test of our time. One very ingenious, and, we think, very useful, contrivance, to which we specially directed our attention, was the telephone apparatus for the use of divers. Without doubt, in diving operations the telephone forms a very important addition to the equipment of a diver. It gives him a means to communicate with those on the surface of the water, and by this means he is able to make known his wants and to receive more prompt assistance in the case of danger. The apparatus consists of a cap, to which is fitted two telephone receivers; this cap is fitted to the diver's head, and the receivers are arranged to cover the ears. The cap is secured by means of a strap and buckle, and the diver's helmet is then placed over the head, but before being secured, a connection piece, which is attached to a flexible cord, is placed in a socket at the side of the cap; this connecting piece and cord is in communication with a magneto-transmitter fitted into the side of the helmet. The telephone for use on the surface is contained in a strong wooden box, and consists of a carbon transmitter, a switch (which is used to connect the battery to the transmitter), and two telephone receivers, one of these being placed to each ear. A cable with an insulated electrical conductor inside is used to connect the instrument used by the diver and the instruments on the surface.



PUBLIC TELEPHONE.

Among the other apparatus which we had the pleasure of inspecting was the domestic telephone, and a public telephone for police, fire alarm and other purposes. The former provides for a means of telephonic communication between rooms or departments of public or private houses, having at the same time an independent connection by private wire with a central exchange system. The arrangement of wire and the mode of operation are very simple. In a house of eight rooms, for example, an instrument is placed in each room, and wires, either separate or in a cable, are then run from No. 1 room to No. 8 room, each of the wires being numbered; these wires are then connected to their respective numbers on the instruments—that is, No. 1 connected to the zero of No. 1 instrument, and to the No. 1 socket of all the other instruments. The battery and earth wires are included in the system and connected to all the instruments, thereby requiring one battery only for the entire system. The mode of operation is as follows: Say No. 1 wants to speak with No. 4, he will insert the plug *A* into socket 4; the act of inserting the plug with slight pressure rings No. 4 bell; then take the telephone from its hook and listen. No. 4 will then have inserted his plug in the zero of his instrument to ask what is wanted. Communication being thus established, one can ring off by again slightly pressing the plug. It is not necessary to remove the plug until a call is received or it is wished to call; in fact, it makes no difference whether the plug is in or out of one of the sockets; or if the telephone is off or on the hook, the call can always be received; but when called it is necessary to insert the plug into zero and speak.

The socket *E* is intended to be connected by private wire to a central exchange system, and is so arranged that, by pressing the button *B*, the exchange may be called. A bell is also provided, so that the exchange may call the subscriber. To arrange this the plug *A* must be inserted into the socket *E*, and *B* be pressed; the telephone is then taken off its hook, and applied to the ear. When through, one can ring off by again pressing *B*. One great advantage of this is, supposing that there is but one private exchange wire included in a system of domestic apparatus, and that No. 4 should want to speak to the exchange; he could do this by calling up No. 1. and asking him to connect his wire through. No. 1 would then insert two plugs, one in socket 4, the other in socket *E*, and ring No. 4, and the exchange then would be in circuit, and No. 1 would still be able to communicate to all others included in the domestic system. To extend the system it is only necessary to provide switches for the additional number of wires run, and to the original strips having sockets and battery connections, as *A*, *B*, *C* and *D*. The switch itself may be included within *A* transmitter, and with or without the zero and *E* socket; strips similar in principle to *A*, *B*, *C* carrying all of the wires.



DOMESTIC TELEPHONE.

The public telephone, as shown by our illustration, is fixed on an ordinary street post, duly protected, and is placed in communcication with any fire-engine station, police station, or any other place for communication, such as docks, etc. By means of an annunciator, placed in any selected spot, it is at once seen from whence the communication is coming, and by using the telephone, which can be placed under lock and key, for the use of subscribers, any necessary communication can be made. Such a telephone, if carried into extensive use, would prove of great service to the public in cases of emergency; keys might, for instance, be granted to any one subscribing a moderate sum, so that a ready means of communication with the police, fire-stations, or a central office might at all times be within reach. We should like to see them erected in all the principal thoroughfares of the metropolis, and the sooner the better, for everybody concerned.

Having thus reflected, we, under the friendly guidance

of the energetic manager, ascended a labyrinth of staircases, and were at length confronted by a number of young people who were winding coils for the Gower-Bell and other telephones, and very expeditiously and very neatly they got through their task. In a small room close at hand a lad was testing the finished coils for resistance by means of a Wheatstone bridge and a tangent galvanometer. The limit of error allowed was, we were informed, about one per cent. on the rough test merely. In conclusion, we have to congratulate Mr. Curtoys upon the evidences of prosperity which were everywhere to be seen; and we advise those who have an hour or two to spare, which they would employ to good advantage, to pay a visit to the birthplace of the telephone.

Telephone Statistics for Europe.

We give below some statistics of the telephone lines of Europe, taken from *L'Ingénieur*. They are said to be to the close of 1884, but many of them are identical with those published in THE ELECTRICAL WORLD of Oct. 18, 1884. Evidently the reports are not complete, or the latter part of the year was not fruitful of results in the introduction or extension of telephonic enterprises. One would naturally expect complete reports from large centres of population, where exchanges have been established for some years, and where the business should be reduced to systematic operation; but our October figures for London are not changed. This is also the case with France. The returns from the northern countries of Europe are more complete, however, and we find that Sweden is showing marked appreciation of the benefits of the telephone, and that the increase in the number of subscribers there shows a larger percentage than any of the others. The increase in Switzerland and Russia is marked, for Europe, but does not keep pace with the rapid growth in this country. We are able to supplement the figures of *L'Ingénieur* in two instances with information from another source. There were 1,105 subscribers in Copenhagen at the end of 1884, and in Holland one company alone, the Nederlandsche Bell Telephone Maatschappy, has 2,400 on its list. The statistics are as follows:

"In Italy, ten cities possessed telephone lines at the end of 1884, against the same number in 1883; but the number of subscribers increased from 3,710 in 1883 to 5,301 in 1884, an increase of 30 per cent. In France, eleven cities had telephonic communication both in 1883 and 1884; the number of subscribers increased from 4,739 in the former year to 5,535 in 1884, an increase of 15 per cent. In Belgium, in five cities, the increase has been from 2,051 subscribers in 1883 to 2,443 in 1884, or 19 per cent. In Great Britain, London had 3,350 subscribers in 1884, against 2,565, in 1883, an increase of 25 per cent. Liverpool, Manchester, Southport, and Blackburn had together 2,359 subscribers in 1883, augmented to 2,734 in 1884, or an increase of 17 per cent. For Sweden, the figures for 1882 and 1884 are available; they show the largest increase for any country. In 1882, only five cities, with 1,554 subscribers, had the telephone; in 1884, fifty-one cities, with 7,737 subscribers, an increase of 398 per cent. in two years. In Holland, in eight cities, we find 1,972 subscribers in 1883, and in 1884, in nine cities, 2,250 subscribers, an increase of 14 per cent. In Switzerland, in ten cities, in 1883 there were 1,778 subscribers, which figures rose in 1884 to twenty-seven cities, with 3,771 subscribers; increase, 112 per cent. In Russia there were in 1883, in six cities, 1,485 subscribers, rising to seven cities with 2,230 subscribers in 1884; increase, 60 per cent. The statistics for the German Empire for 1883 and 1884 are not yet published. There were 1,500 subscribers in Berlin in June, 1884. In Austria, at the end of 1883, eight cities only had telephone lines; there were 708 subsribers at Vienna in December, 1884. In Norway, on June 30, 1883, two cities (Christiania and Drammén) had 755 and 150 subscribers respectively. In Denmark, Copenhagen had 516 subscribers in June, 1883. In Portugal there were, at the end of 1883, telephone lines in Lisbon with 343 subscribers, and in Oporto with 183 subscribers. Spain is the only country which has no telephonic communications as yet, but a law was recently passed by the Cortes reserving to the government the telephonic monopoly."

One other point deserves attention, and that is the number of telephones in Sweden, as compared with France. Since our October figures for France are not amended, it is fair to assume that the number of telephones in France is understated. It is scarcely to be believed that France, with its 38 million people, will come halting behind Sweden with its 5 million, and yet these figures show that there are 30 per cent. more telephones in the latter country. The total seems to be very near 40,000, but we think this must be much under the actual number.

The Influence of Magnetism on Chemical Action.

In a short note relating to the above subject in the *American Chemical Journal*, Prof. Ira Remsen writes as follows:

Some time ago I described an experiment which seemed to prove that chemical action is, under some circumstances, influenced by magnetism. I afterward found that somewhat similar experiments had been performed by Robert Hunt, and that after Hunt, Wartmann had worked on the subject, and had come to the conclusion that magnetism does not influence chemical action. In 1882, at the fall meeting of the National Academy of Sciences, I gave an account of later experiments by myself, and stated that the work would be continued. In 1883, in Vol. I., No. 2, of *Science*, I published a short paper, in which I called attention to the fact that I was engaged in repeating Hunt's experiments, and I proposed to continue the investigation as long as there seemed promise of obtaining results of value. The work has suffered some interruption since then, but has at no time been given up. The unsatisfactory results reached in repeating Hunt's experiments have interfered with work in new and more profitable directions. Lately I have secured the services of an assistant, and am now pushing the investigation forward as rapidly as the character of the work will permit. We have already obtained some extremely interesting results in depositing various metals upon iron and nickel under the influence of a powerful magnet, and we are now engaged in the study of the action of various acids on metals. We have found that when iron in a magnetic field is treated with nitric acid, certain parts of the iron are protected, while other parts are dissolved with varying degrees of rapidity according to the position with reference to the protected parts. Experiments with hydrochloric acid give similar results, though it appears that the parts protected are not the same as in the case of nitric acid. A full account of the results reached will be published in due time. The object of this notice is merely to call the attention of other workers to the fact that my work on the general subject of chemical action in a magnetic field has not been abandoned, and that through the aid of the trustees of the Bache fund it is now in my power to continue it without interruption. I have no desire nor right to prevent others from working in the same field, but I should be glad to communicate with any one who may contemplate undertaking such work, as unnecessary duplicating may thus be avoided.

Arc Lamp Magnet.

To the Editor of The Electrical World:

SIR: Will you please inform me what size of magnet wire and what length should be wound on a piece of half-inch iron pipe 2½ inches long to make an electro-magnet to be included in the main circuit of an arc lamp? The lamp to work in an ordinary arc lamp circuit.

Flint & P. M. R. R., Michigan. SUBSCRIBER.

ANSWER.—No. 12; length, 15 ft.

Electro-Magnet Coils.

To the Editor of The Electrical World:

SIR: Will you please inform me through the columns of THE ELECTRICAL WORLD which would be preferable in the following case: I wish to make a coil of an electro-magnet, of which the resistance can be varied by division of the core into three parts or smaller coils. Would it be best to wind these as three coils side by side on one common core, or to wind them one over the other so as to form three sets of layers. I wish to vary the resistance by having sometimes one and sometimes other of the coils in the circuit. CHAS. E. OLDACRE.

NOBLESVILLE, Ind.

ANSWER.—For ordinary purposes the latter is far preferable. The former would be useful in a very limited number of devices.

Electrical Measurements.

To the Editor of The Electrical World:

SIR: Will you inform me which is the best work you have on "Electrical Mensuration." Will you also tell me the relative resistances of wire to wind on the field-magnets and armature and external resistance, series, shunt or compound wound?

By answering you will greatly oblige a constant reader of your esteemed paper. A. F. KEARNS.

BROOKLYN, N. Y.

ANSWER.—Monro & Jamieson's "Pocket Book of Electrical Rules and Tables" is the book which will aid you and answer the questions you ask. Wigan's "The Electrician's Pocket Book" is also a work containing in detail the information you seek. Both can be obtained from this office.

Carpet, Shoe Friction and Dry Air.

To the Editor of The Electrical World:

SIR: Mr. Anderson, of Marion, Ind., in your issue of March 28, asks for an explanation of certain electrical phenomena.

The principles involved are the same as those which led to the discovery and naming of this wonderful agent of man.

It is frictional electricity developed by the friction of the shoes on the carpet, and is observable in almost any house or room with a carpet on the floor, providing the air be sufficiently dry.

We frequently hear of this or that person being so strongly electrified that they can light the gas by sparks from the finger. If investigated, the source of the spark is almost invariably found in the friction between the person's shoes and the carpet of the room, or the judicious application of a small piece of catskin to his clothing, in the same manner as is employed in charging an electrophorus.

By moving over the carpet with a sliding motion, the writer has caused sparks a half inch in length to pass between his finger and the stove, gas-pipes or any other good conductor, though it is not necessary that the conductor be connected to earth. The transfer of electricity takes place readily from the charged person to any uncharged conductor, and if the latter be insulated from the earth and the air be very dry, a spark may be drawn from it by bringing it near to another uncharged conductor. If one person sit still upon a chair or remain standing quietly, another person may communicate to the first quite a severe shock, by simply making a few movements of the feet, as though skating, and then presenting his finger, or any conductor held in his hand, to the first person, and he can communicate the same charge, though in a lesser degree, to a third person.

In bright, snapping cold weather, the "phenomenon" is strongest, and in damp weather entirely absent.

CHICAGO, March 31. L. O. MCPHERSON.

Dynamo Winding.

To the Editor of The Electrical World:

SIR: I have been a subscriber to *The Operator* and THE ELECTRICAL WORLD for several years, and derive much benefit therefrom. Now, if it is not asking too much, would you inform me what the proper proportions are of the wire on the armature and that of the fields as regards size, resistance, etc., of the Gramme ring type of dynamo?

For instance, I have a ring, say 6 inches in diameter, 3 inches wide, wound with No. 20 wire, 11 layers, about 8½ pounds weight of wire.

What would be the proper wire for field, and ought I to get enough from it to light 10 incandescent lamps of 10 candle-power each?

Also, which is the best way to connect fields, shunt or series?

Having some No. 22 wire, I tried it on fields (about 10 pounds), with very poor results. It would scarcely light one lamp of 8 candle-power. I also cut out about one-third of the field, but did not improve it. DYNAMO.

ANSWER.—See answer to Mr. Kearns' question. In general, the electromotive force depends upon the velocity of rotation, upon the diameter of the ring and upon the number of coils upon the armature measured in the direction of the armature's circumference. Your experiment proves that your machine is of too small dimensions to obtain sufficient electromotive force for the lamps on hand. We think your dynamo would run four or five lamps of lower resistance.

The Telephonic Telegraph.

To the Editor of The Electrical World:

SIR: As our apparatus for the simultaneous transmission of telephonic and telegraphic messages has now been in operation on the wires of the Great Northwestern Telegraph Company since the 7th of January last, I presume a report of the practical results attained will be of interest. The apparatus has been used under the following conditions:

1. On a line 40 miles long, as an artificial metallic circuit (80 miles of wire).

2. Using telephonic-telegraph apparatus simultaneously at one intermediate and at two terminal points, the latter being 40 miles apart.

3. On a metallic circuit with 176 miles of wire.

4. Using a terminal ground wire at each end and two telegraph wires as a double conductor.

Under conditions 1 and 2 the telephones worked quite satisfactorily, and fully as well as if the wires were being used exclusively as telephone wires.

Under the third condition, namely, using 176 miles of wire as a metallic circuit, the telephones did not work easily, but perhaps as well as on the same length of telephone trunk lines. With good wires, however, I believe we would have no difficulty in working between stations 100 miles apart.

On attempting to use two wires as a double conductor, grounding at each end, we found that instead of the induction on one wire being neutralized by that on the other, as is the case with the metallic circuit, the one was reinforced by the other and the induction was something terrific.

The most practical outcome of our experiments, however, is the proposition to utilize telegraph wires as artificial trunk lines for connecting telephone exchanges. But I anticipate. The results of our experiments up to the present can be stated as follows:

We have demonstrated—

1. That a single wire may be used simultaneously for telephonic and telegraphic messages without interference.

2. That two telegraph wires may be used to form an artificial metallic circuit for the telephone service.

3. That telephone wires may be conducted alongside telegraph wires on the same supports when the latter are equipped with our telephonic-telegraph apparatus.

4. That telegraph wires may be utilized by telephone companies as artificial trunk lines for connecting telephone exchanges.

The importance of the latter fact needs simply to be mentioned in passing. If the telegraph companies and the telephone companies can come to an arrangement whereby the latter can lease artificial or phantom trunk lines from the former, an immense saving in capital for the construction and maintenance of trunk lines would thereby be effected. A. ROSEBRUGH.

TORONTO, Can., April 4.

WESTERN NOTES.

THE ELECTRICAL WORLD BRANCH OFFICE,
CHICAGO, April 6, 1885.

The American Portable Telephone Company of Denver has been organized with a capital stock of five hundred thousand dollars in ten-dollar shares. The incorporators and stockholders are among the solid men of Denver, and the company will commence at once the introduction of its apparatus for prospecting, mining and railroad construction purposes. The company's territory comprises Colorado, Wyoming, Montana, Kansas, Dakota, New Mexico, Arizona and Nebraska. This would seem to be a fine territory for the introduction of their apparatus, and the company will undoubtedly do a paying business. The prospects of the Home American Portable Company, by the way, seem to be exceedingly bright just now. It has come to my knowledge that five thousand shares of the Home or parent company's stock have been sold in Chicago lately at par, and negotiations are pending for the organization of a local or sub-company in Mexico, to be called the American Portable Telephone Company of Mexico. The operation of the company's apparatus for mining purposes alone would probably pay handsomely in Mexico, not mentioning the other applications to which the system could be put. The Mexican negotiations will probably be closed in a few days now.

Capt. Lina Beecher, the general manager of the parent American Portable Telephone Company, is in correspondence with the British military authorities at Ottawa, concerning the use of the apparatus by the government in their operations against the revolutionary forces in the Northwest, and has had a proposition made him by the Ottawa authorities to go on there and drill a corps of men for military telephone service. The adaptability of this apparatus to field service, to take the place of the military telegraph, finds an illustration just now in the troubles with the Northwestern revolutionists, and the Canadian authorities are quick to see the advantage of a field telephone service and prompt to make efforts to adopt it. It is said that the revolutionists have cut the telegraph wires right and left in the territory in which they are operating.

The introduction of the Western Electric Company's electric lighting apparatus in Mansfield, Ohio, has led the local *Herald* to interview a large number of people with a view to ascertaining, if possible, whether the new illuminant is likely to cause any falling off in the revenue of the gas company. One of the stockholders of the gas company thinks that the introduction of the electric light will not ultimately affect the consumption of gas, as it is more expensive, and many will probably abandon it after a little. Another gas man thinks the introduction of a new kind of gas burner will prove a great rival to the electric light. It is evident, from the interview, that Mansfield is being introduced to the electric light for the first time, and that its gas men are not acquainted with the rapidity with which the electric illuminant walks into general favor.

A company has been incorporated under the laws of the State of Kansas to build a telegraph line from Kansas City to San Francisco, Cal. The incorporators include prominent Western bankers, and judging by the manner in which they have started out, the scheme will probably be carried into a reality.

The Badger electric light plant, at 10-12 Arcade court, Chicago, is now operating four dynamos and from 110 to 145 lights nightly, the latter number being the present capacity of the plant. I have already mentioned the fact that it is intended to increase this plant to 300 arc lights, and I now learn that in addition to this, 3,000 incandescent lamps, of the Mather type, are to go in, and that a special building is to be erected as a central station. The whole plant will be run by the Badger Electric Company and the lamps rented to whoever wants them. Mr. Badger informs me that a large number of the additional lamps are already spoken for, and that the plant, when increased as above, will be none too large for the growing business of the company.

The Badger Electric Company, of Keokuk, Iowa, has been organized to run an arc and incandescent renting business at Keokuk. Sixty Brush arc lights and 1,000 Mather incandescent lamps are expected to be burning by the first of May. Work is proceeding on the plant, and much of the apparatus is already there. Mr. Badger is an energetic, pushing business man, and seems to be stirring things up in the electric lighting field at a lively rate.

I notice that the Giles anti-magnetic shield for watches —which has been described in THE ELECTRICAL WORLD— is gaining in favor among electrical people and those liable to be brought into the neighborhood of dynamos. Giles Brothers & Co., State and Washington streets, Chicago, have already taken a considerable number of orders for watches and shields, though the appliances are hardly on the market yet. Mr. Giles offers to prove that an ordinary watch, if provided with the shield, will show better results as a time-keeper than a four-hundred dollar watch without it. The writer saw a watch provided with the Giles shield which ticked along uninterruptedly when placed on a 1,200-light Edison dynamo machine. It is easy to imagine what would have happened had the watch been without the shield.

Among the recent orders reported by the Western Edison Light Company are 850 lights for the Chicago Board of Trade; 1,000 lights for McVicker's Theatre, Chicago; 300 lights for the Milwaukee County Asylum for the Insane; 200 lights for the Milwaukee County Hospital and Asylum for Idiots; 250 lights for the Counselman office building, Chicago; 25 lights for J. Schaupp & Son's flouring mill, Grand Island, Neb.; 25 lights for the A. W. Keeny paper mill, Rockford, Ill. They have also just fitted up the A, B and Anchor mills of Chas. Pilsbury & Co., at Minneapolis, Minn., with 300 lights. The B and Anchor mills, by the way, are 2,500 feet away from the power, but successful transmission is secured by the Edison three-wire system generally used for central stations.

The result of the inquest by the coroner's jury goes to substantiate the statement of Mr. Fay, general manager of the Chicago Telephone Company—that the falling of the wall in the Langham Hotel fire was not due in any way to the arrangement of the telephone wires on the roof.

J. D. Simpson & Co. is the name of a new electrical firm at 162 La Salle street, Chicago.

The houses of Edw. Harbert & Co. and S. Harbert & Co. have consolidated, and the new firm will probably do business hereafter from No. 159 La Salle street, Chicago.

The *Times*, probably having in mind the well-known desire of Chicago aldermen to be "seen" when any important contracts are to be let, has the following to say in regard to the electric light appropriation: Now that the Council has made an appropriation for lighting the new City Hall and tunnels with electricity, the prospect is that the rival electric light companies and the aldermen will get pretty well acquainted. Several of the electric light gentlemen were around yesterday inquiring into the situation of affairs, and a deluge of them will, no doubt, be on hand just as soon as the appropriation has been perfected beyond all question. One firm has already addressed the Council on the subject, inquiring whether it is proposed to buy a plant, to be operated by the city, or let the furnishing and care of the light by contract to the lowest bidder. They seem inclined to think, however, that since the amount appropriated for the purpose is identical with the amount another firm offered to furnish a plant for about two months ago, the fight has been substantially decided against them in advance; but they are by no means disheartened, and when the time comes promise that they will be to the front with propositions to furnish either the plant or the light, or both.

A lengthy bill was filed March 25 in the United States Circuit Court by the Chicago Sectional Electric Underground Company against the Postal Telegraph and Cable Company, the Bankers & Merchants' Telegraph Company, Richard S. Newcombe, and James B. Smith, to compel them to live up to a certain agreement. The complaining company was organized in the summer of 1882, and authority by ordinance was given it to lay underground wires and pipes throughout the city. Shortly afterward Elisha Gray leased the right to use the lower compartment of a conduit from Thirty-ninth street to the office of the Postal Telegraph Company, near the corner of Washington and La Salle streets. This lease soon afterward was assigned to the Postal Telegraph and Cable Company. In April last the complainant granted to the Bankers & Merchants' Telegraph Company, for a period of about twenty-three years, the right to construct, maintain, repair, and operate in the South Division all the lines of electric conductors they chose to erect and operate, the lines, when laid, to belong to complainant and to be laid in its conduits. The lessee was, however, to use such wires and pipes for its own use only, including its district messenger service and excluding other district messenger service and all telephone service, and agreeing that in case of violation of any of the covenants of the lease the latter might be forfeited. About the same time the Postal Telegraph and Cable Company was granted permission to extend its wires over the South Division, and to use the upper half of the conduit it already had on payment of $35,000. This was to be paid in its own bonds at 60 cents on the dollar of the par value. The sum of $21,000 was paid for the additional half of the old conduit, and the Postal Company agreed to pay $14,000 for the other rights. During the summer of 1884 the Bankers & Merchants' Company excavated a large amount and laid considerable pipe, and the Postal Company claim to own certain portions of the pipe by purchase from the Bankers & Merchants' Company. The complainant charges that the latter company had no right under its lease to confer such power, and that all pipes and wires, as soon as laid by the latter, became complainant's property. The Bankers & Merchants' Company was expressly forbidden to allow the Postal Company to use its pipes, but it has nevertheless permitted the latter to run wires from the Grand Pacific Hotel to its wires on Clark street and to the Open Board of Trade Building, and the Postal Company is now trying to connect with the new Board of Trade. In September last, Newcombe and Smith were appointed receivers of the Bankers & Merchants' Company and immediately took possession of its property and rights. When the complainant, in January, 1885, first learned that the Bankers & Merchants' Company was illegally allowing the Postal Company to use its lines, it induced the receivers to cut the wires of the Postal Company. The latter then filed a petition for injunction, and the Bankers & Merchants' Company coolly notified complainant that they must protect them in their lease when they had already broken it themselves. A temporary injunction has been issued restraining the Bankers & Merchants' from interfering with the Postal Company, which the Bankers & Merchants' Company has yielded without trying to have it set aside. The Postal has recently been slow in performing its promises to pay the remaining $14,000 of the contract of last summer for the extension of its lines, hoping to be able to make some satisfactory arrangement with the Bankers & Merchants' Company. The complainant charges that the Bankers & Merchants' and Postal companies have been conspiring together to defraud it, and it asks that the Bankers & Merchants' may be prevented from allowing the Postal to use its conduits or wires, and that the latter company may be compelled to specifically perform its agreement to lease additional facilities and pay over the $14,000 as it promised. A motion for temporary injunction was made before Judge Gresham, March 20, and postponed for two weeks by request of defendants.

THE TELEGRAPH.

Geographical Survey.—The organization of the United States Geographical Survey, as described by Mr. J. W. Powell in the *American Journal of Science*, comprises an astronomic and computing division, the officers of which are engaged in determining the geographical co-ordinates of certain primary points; a triangulation corps engaged in extending a system of triangulation over various portions of the country, from measured base lines; and a telegraphic corps, organized into 27 parties, scattered over various portions of the United States.

Central American Cables.—Mr. Batres, the new Minister from Guatemala and Honduras, and Mr. Baiz, the Consul for those countries, have sent a communication to the President of the Central and South American Cable Company, in which they say that Guatemala had and still has no intention to cut his cable or that of any other company. They also state that the report arose from the fact that a steamer intended to land a passenger on the coast by means of a small boat, and claim that the news from La Libertad, Salvador, is colored by the censor to the detriment of Guatemala and Honduras.

For the Suakin Railway.—The equipment for constructing the railway from Suakin to Berber includes the following: Six sets of electric light apparatus for six 1,000 candle lights, with six spare lamps and three spare lanterns to work on 4 feet 8½ inch gauge, trolleys and shears, crabs, ropes and brackets, 500 yards of cable, all complete for lamps, 4,000 feet carbons, wrought-iron dust-proof case with each set. Six sets of ditto (fitted on trolleys 4 feet 8½ inch gauge), each of six lengths (Brush), and 800 yards of cable, with lamps, lanterns, carbons for 2,000 hours each lamp, poles, crabs and appliances for lamps complete. Six sets of telegraphic apparatus (5 miles in each set), with alphabetical instruments and telephones complete, two spare sets of telegraph and four spare sets of telephone instruments.

Stamped Blanks.—The Baltimore & Ohio Telegraph Company announces to its patrons, and the public generally, that it has inaugurated another new idea in the telegraph business, by issuing commutation books of telegraph stamps for the convenience of its customers in preparing their telegrams: For example —a ten-word telegram from New York City to Wheeling, W. Va., with a 25-cent stamp affixed, will be accepted at any Baltimore & Ohio telegraph office for transmission in the same manner and under the same conditions as if the cash accompanied such telegram. Each book contains stamps of various denominations, to the amount of $11.22, and they can be purchased at the principal Baltimore & Ohio telegraph offices for $10 each, which is equivalent to a rebate of over ten per cent. on the already extremely low rates.

THE TELEPHONE.

Mr. Alexander Graham Bell, of Washington, has been staying at the Brevoort House, this city. It is said that he will leave shortly for Europe.

The Canadian Opposition.—It is understood that a subscription of $500,000 has been pledged by capitalists of Boston for a telephone company to operate in Canada in opposition to the American Bell Telephone Company's patents.

London Facilities.—The United Telephone Company now keep their exchanges in London open from 9 A. M. to 9 P. M., the west-end exchanges being also kept open all night during the sitting of Parliament. Arrangements have been made by which subscribers to the exchanges can send and receive telegrams direct through the Central Telegraph office.

Telephoning "Ads."—A firm of advertising agents in London received on the 17th ult., direct by telephone from Brighton, the actual words and instructions respecting insertion of an advertisement in a daily paper of the 18th. The whole transaction only occupied a couple of minutes. This is believed to be the first practical use of the telephone for newspaper purposes over so long a distance—at least, in England.

An Intelligent Policeman.—Now that the residents of Longueuil have got the use of the telephone wires on posts across the ice-bridge, they are being used to some purpose. A laugh was enjoyed a few days ago by some friends of a gentleman who is connected with a firm in this city. The gentleman in question left recently on a trip to Halifax, and as the dread of Wiggins' storm preyed upon his wife's mind, he promised to keep her posted as to his whereabouts. On reaching Halifax he lost no time in telegraphing to a friend in this city that he had arrived, and requested that his wife, who resides in Longueuil, should be informed of the fact by telephone. The friend immediately rang up the policeman who is in charge of the telephone in the Longueuil Town Hall and delivered the message. The policeman went off post haste and informed the lady that her husband telephoned from Halifax "that he have not arrived." The lady said, in reply, "there must be some mistake." "Well, 'spose so," said the policeman; "the telephone speaks as if he got very bad cold."—*Montreal Witness.*

THE ELECTRIC LIGHT.

The City of Mexico.—Sixteen iron towers and other materials have arrived in the City of Mexico, to be used in electric lighting.

New Lots, Long Island.—The New Lots (N. Y.) Electric Lighting Company was incorporated at Albany, N. Y., on the 6th inst., with a capital of $15,000.

Examining Gen. Grant's Mouth.—During the past week an examination of the cancer in Gen. Grant's mouth was made by means of a small incandescent lamp. It is a wonder the doctors did not think of this help sooner.

St. Etienne, France.—This town is to have the first central station opened in France. The installation comprises 3,000 Edison lamps of 8 and 16 candle-power, lit by 5 A dynamos of 500 each, and one dynamo is held in reserve. The dynamos will be driven by four 70 horse-power engines. The plant will be ready by September, and a great many persons have subscribed for five years.

Samples Wanted.—A *new* incandescent electric lamp has been perfected and is about to be patented by a physicist in this city, for which the advantage is claimed that, candle for candle, it can be operated with about one-fifth the current required by an Edison, Swan or Maxim. The new lamp is said to be very simple in construction and takes advantage of a newly discovered principle of physics in producing the incandescence. The light is the same in all azimuths.—*Bryn Mawr (Pa.) News.*

Big Battues.—Statistics collected by the American Ornithologists' Union show that great numbers of birds are destroyed by flying against the lighthouses of Cuba. At Paredon Grande more than 100 birds were found one morning; in one night last October 278 were killed by flying against the lighthouse at Cardenas; and at the San Antonio lighthouse more than 500 are sometimes picked up after a single night's destruction. Thus is confirmed the view expressed by Professor Spencer F. Baird, twenty years ago, that every autumn a great bird wave sweeps over from Florida to Cuba.

Starting Dynamos with Gas Engines.—In electric light installations where dynamos are driven by gas engines to feed accumulators, the dynamo is started by a current from the accumulator, and the gas engine put in action. On turning the current from the accumulator through the dynamo, it happens in some installations that great sparking ensues, unless the current is turned on gradually through a resistance, but with a machine having very low resistance armatures this precaution is unnecessary. Sir David Salomon points out that in the case of dynamos having a considerable armature resistance, the flow of current from the accumulator is limited in most cases to within the capacity of the cells, and there is no appreciable fall of electromotive force, so that there is a strong current in the shunt coils, and a strong magnetic field, which together with the large current in the armature, produces the sparking, if no resistance be inserted at the start. In the case of low resistance armatures more current is permitted to flow from the cells than they ought to give, hence there is a fall of electromotive force and a weak field, because a small current flows through the shunt coils. Therefore the motor starts steadily, and the power rises as the speed increases, the counter electromotive force gradually diminishing the current in the armature until the capacity of the accumulator is reached, when the ordinary laws affecting motors come into operation. In all cases, therefore, Sir David concludes, it is advisable to start the gas engines with a variable resistance inserted, since it preserves both the dynamo and cells from injury.

APPLICATIONS OF POWER.

Proposed Railway for Philadelphia.—At a meeting of the Commissioners of Fairmount Park, Philadelphia, on April 4, a communication was received from the Bidwell Railway Company asking the privilege of building a track for an electric railway in the Park, a reasonable compensation to be charged, not to exceed 5 cents for each passenger, and the company agreeing to furnish light free of cost to the city along the said road by means of electricity; said railway to be commenced at any time upon sixty days' notice, and such portions of the Park over which the road may pass to be put in the same condition as when the company commenced to build. The matter was referred to the Committee on Superintendence and Police.

To Handle the Van Depoele Motor.—On Saturday, April 4, a number of capitalists of New York, Newark, Elizabeth and other cities met at the Sheridan House, Elizabeth, N. J., and organized what will hereafter be known as the "Eastern Electric Company," with a capital of $250,000. The following were chosen directors: Hon. Robert S. Green, F. M. Waterbury, F. W. Stillman, and W. H. Gillett, of Elizabeth; Dr. H. A. Johnson, of Easton, Pa., and George S. Bowen, of Chicago. Afterward the following officers were elected: President, Robert S. Green; Vice-President, H. A. Johnson; Treasurer, F. M. Waterbury; Secretary, James McK. Graeff, and W. H. Gillett, Superintendent. The purpose of the company is the introduction and sale of Van Depoele electric motors for surface and elevated roads. They will construct a tower 150 feet high in the principal part of the city, the lights from which (four in number) will, it is claimed, throw a brilliant light 2,000 feet.

Electro-Magnetic Milling.—Here's the latest idea as to electrical application: The head miller sits in a handsomely carpeted and luxuriously furnished office, his feet easily thrown up on a desk-like structure before him. Within easy reach are a series of electrical buttons, over which are designating words. To his left are a series of electrical bells, also provided with designating words. Now, a farmer drives up with a load of wheat, and the scale bell tinkles the fact to the head miller, who, with his right hand, presses the button which opens the door to the scale hopper. The farmer dumps his wheat therein, and its weight is at once shown up to the head miller by figures electrically displayed. While this is being done another bell rings, and the words, "Feed Out," or "Spout Choked," or other specifying phrases are shown him, and he, by simply pressing the proper button, remedies all difficulties, and continues smoking. Pretty nice outlook for the dusties, don't you think so?—*Milling World.*

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 53, a 55; B. & M., b 2, a 3; Mutual Union, b 16¾, a 20; Western Union, b 57⅛, a 57¼.

Telephone.—Am. Bell, b 220, a 222; Erie, b 21; New England, b 27¼, a 27½.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles Brothers & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches which are already affected.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED MARCH 24, 1885.

Armature for Dynamo-Electric Machines; Clarence L. Healy, Brooklyn, N. Y., Assignor to Stephen D. Field, Yonkers, N. Y..... 314,242

Consists of the combination, in an armature of a dynamo-electric machine, of an armature-core and a winding therefor, consisting of a compound conductor composed of wires insulated from and arranged spirally around one another.

Means for Generating Steam by Electricity; Walter W. Vaugn and Edward D. Eldridge, Stockton, Cal., Assignors to themselves, W. W. Paddock, Henry W. Devoil, Edward E. Eldridge, Chas. A. Eldridge, Joshua P. Webster and Asa Clark..... 314,277

Platinum wire is passed through the flues of the boiler and heated to incandescence by means of the current.

Electric Signaling Apparatus; F. Benedict Herzog, New York, N. Y.....314,292, 314,293, 314,294

First invention.—The arm *Q* is first set by pressing in the knob *A*, which slightly bends the arm and frees the lug *V* from the teeth, and as this arm rests in front of the other two, it also pushes inward the others and unlocks them, so that the arm *Q* can be set as desired, and will carry with it the other arms if they happen to be set close up to it, and if not the arm *Q* may be set independently without moving the others. The second and third arms are then set one after the other in the same manner; but as the second arm lies behind the first and the third behind the second, either of these may be unlocked and set without affecting the

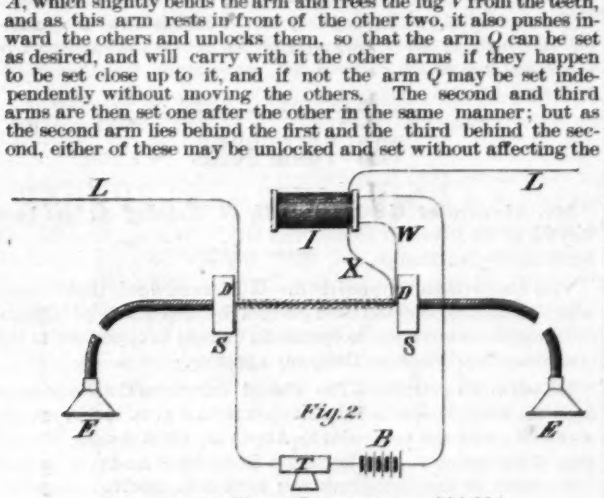


Fig. 2.

TELEPHONE—FIRST INVENTION. 314,304.

ones in front of it. In other words, any arm may be unlocked and set without unlocking those in front of it; but it will unlock all those behind it, and consequently it is only necessary to set first those in front.

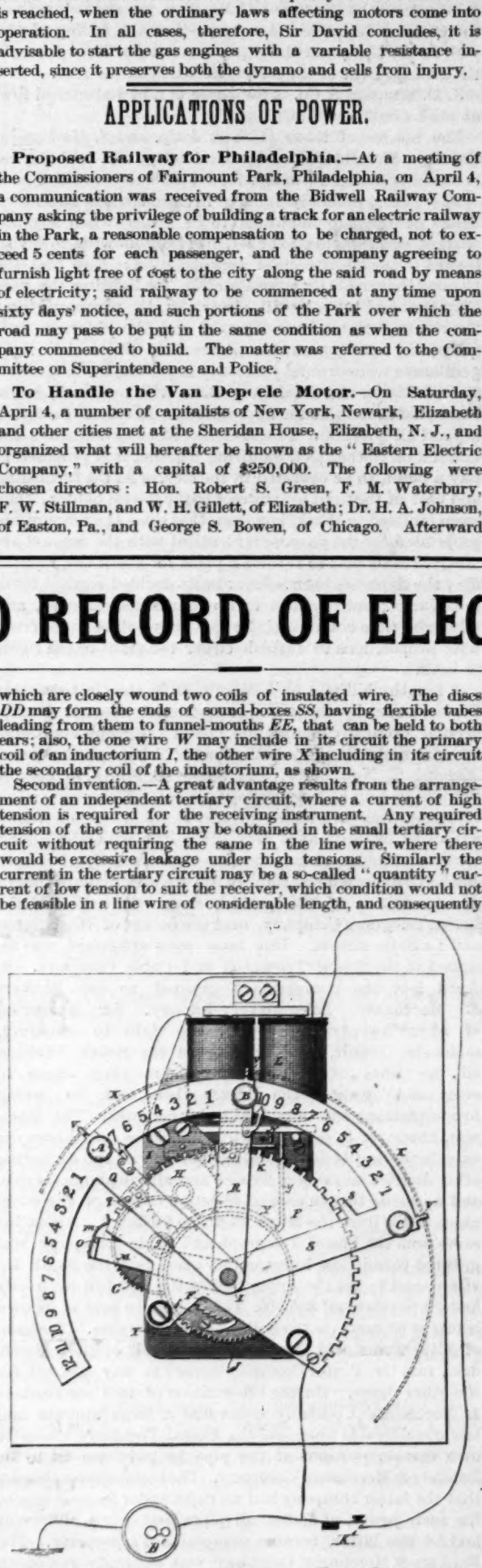
Second invention consists of a circuit system containing two or more electrically connected stations at one of which (the sending station) is a latent-signal transmitter and calling apparatus, and at the other of which (the receiving station) are apparatus responding to the said calling apparatus and latent-signal transmitter, and means for transmitting an impulse over the circuit to release said latent-signal transmitter, the hereinbefore-described method of signaling consisting in first setting at the sending station the latent-signal transmitter, and sending in a call from the station to indicate to the receiving station that the transmitter is set and ready to be operated, and then at the receiving station, upon receipt of said call, operating the releasing mechanism to release the latent-signal transmitter at the sending station.

Third invention consists of the combination, with a single circuit, a latent-signal transmitter, and calling apparatus for informing the receiving station that the latent-signal transmitter is set, of a circuit-changer at the transmitting station, whereby the call may be operated without thereby releasing the latent-signal transmitter.

Telephones; Henry Alabaster, South Croydon; Tom Ernest Gatehouse, Camberwell, and Harry Robert Kempe, Barnet, England. 314,304, 314,305, 314,306, 314,307

First invention.—At each end of a suitable case is fixed a disc *D*, and stretched between these discs is an iron or steel wire, round which are closely wound two coils of insulated wire. The discs *DD* may form the ends of sound-boxes *SS*, having flexible tubes leading from them to funnel-mouths *EE*, that can be held to both ears; also, the one wire *W* may include in its circuit the primary coil of an inductorium *I*, the other wire *X* including in its circuit the secondary coil of the inductorium, as shown.

Second invention.—A great advantage results from the arrangement of an independent tertiary circuit, where a current of high tension is required for the receiving instrument. Any required tension of the current may be obtained in the small tertiary circuit without requiring the same in the line wire, where there would be excessive leakage under high tensions. Similarly the current in the tertiary circuit may be a so-called "quantity" current of low tension to suit the receiver, which condition would not be feasible in a line wire of considerable length, and consequently



ELECTRIC SIGNALING APPARATUS—FIRST INVENTION. 314,292.

of high resistance. The cut shows the principle underlying the disposition of the circuits.

Third invention.—The patent has a broad claim on a peculiar molecular condition of the iron core as prepared by a special process. The invention includes also a rod connecting the diaphragm with the iron core at right angles to both.

Fourth invention.—Relates to the disposition of the electrodes, which are so placed as that one forms a bridge to receive the vibrations of the air.

Telephone; Francis Blake, Weston, Mass..... 314,312

One part of the invention relates to the construction of an electrode which is buried in the granulated material and admits such free movement thereof, and at the same time gives a large cross-section, and consequently a comparatively low resistance, to that part of the circuit.

Another part of the invention relates to a method of connecting the diaphragm with the electrode, which is buried in the loose material, so that the diaphragm is strained, and so that the vibrations of the diaphragm shall affect the loose material more uniformly, and shall be communicated directly to said buried electrode.

Adjustable Support for Telephone Receiver; John M. Fitch, Detroit, Mich..... 314,371

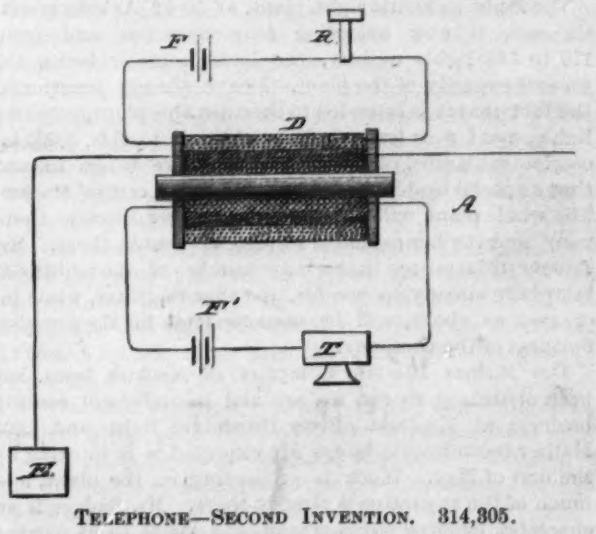
Consists of an adjustable support for a telephone receiver, comprising a single arm turning on a vertical pivot arranged centrally over the stationary transmitter, so that said arm may swing laterally in front of the transmitter from one side to the other thereof, and having in the free end of said arm a swivel-clasp, whereby the receiver may be turned for use at either ear of the operator.

Holder for Lightning Rods; Spencer R. Lawshe, Greencastle, Ind., Assignor to Theodore H. Patee, of same place..... 314,385

Consists of a holder in which the inclosing portion is composed of two arms, one or both of which are movable, whereby it may be adjusted to firmly encircle the rod or insulator and retain it in place.

Electric Signaling Circuit; Thomas D. Lockwood, Malden, Mass.....314,386

The gist of the invention lies in the combination of an alternating current-generator with single-stroke non-polarized bells, in such a way that the intermitting currents of even direction delivered from one-half of each revolution of the generator-armature may be successively directed through one or more bell-circuits, a continuous ring upon the bells included in said circuits, while the intermitting currents of opposite direction developed by the remaining half of each revolution may be similarly utilized to ring bells connected with a second series of circuits.



TELEPHONE—SECOND INVENTION. 314,305.

Electric Arc Lamp; Clinton M. Ball, Troy, N. Y... 314,418

Consists of the combination, with carbon-holders and feed mechanism, of an electro-magnet having two separate helices wound upon the core or cores in the same direction, one being in the main circuit through the carbons, the other in a shunt, the feed mechanism being controlled by the magnetism.

Morse Register; Edouard Estienne, Paris, France. (Patented in foreign countries)..... 314,525

Consists of the combination of the feed-roller of a telegraphic register and two levers, one carrying a marking-pen having a wide point to form a long stroke, and the other a narrower point to form a short stroke, with armatures and electro-magnets acting on the latter and an arm or arms moving with the armatures to operate the pen-levers.